Conference Proceedings

3rd International GET UP Workshop on University Based Start-Ups:

"International cooperation of universities and its impact on university based start-ups"

29 – 31 October 2004
University of Applied Sciences Jena

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(Eds.)

ISBN 3-00-014920-1

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Entrepreneurship and Economic Growth: The Role of Public Policy

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1. Introduction

Perhaps one of the less understood phenomena accompanying the increased globalization at the beginning of the 21st century has been a shift in the comparative advantage of high-wage countries towards knowledge-based economic activity. An important implication of this shift in this comparative advantage is that much of the production and commercialization of new economic knowledge is less associated with large traditional corporations and more associated with high-tech entrepreneurial firms found in innovative regional clusters, such as Silicon Valley, Research Triangle and Route 122. Only a few years ago the conventional wisdom predicted that globalization would render the demise of small firms and the importance of geographic location. Yet the obsession of policy-makers around the globe to "create the next Silicon Valley" reveals the increased importance of entrepreneurial firms taking advantage of geographic proximity and regional agglomerations. The purpose of this paper is to explain why and how a new type of public policy has emerged – the strategic management of places – and the central role that entrepreneurship plays in this new policy.

2. What is Entrepreneurship?

While it has become widely acknowledge that entrepreneurship is a vital force in the economies of developed countries, there is little consensus about what actually constitutes entrepreneurial activity. Scholars have proposed a broad array of definitions, which when operationalize, have generated a number of different measures (Hebert and Link, 1989). Herbert and Link (1989) have identified three distinct intellectual traditions in the development of the entrepreneurship literature. These three traditions can be characterized as the German Tradition, based on von Thuenen and Schumpeter, the Chicago Tradition, based on Knight and Schultz, and the Austrian Tradition, baased on von Mises, Kirzner and Shackle. The Schumpeterian tradition has had the greatest impact on the contemporary entrepreneurship literature. The distinguishing feature from Schumpeter is that entrepreneurship is viewed as a disequilibrating phenomenon rather than an equilibrating force. In his 1911 classic treatise, *Theorie der wirtschaftlichen Entwicklungen* (Theory of Economic Development), Schumpeter proposed a theory of *creative destruction*, where new firms with the entrepreneurial spirit displace less innovative incumbents, ultimately leading to a higher degree of economic growth. Even in his 1942 classic, Capitalism and Democracy, Schumpter (p. 13) still argued that entrenched large corporations tend to resist change, forcing entrepreneurs to start new firms in order to pursue innovative activity: "The function of entrepreneurs is to reform or revolutionize the pattern of production by exploiting an invention, or more generally, an untried technological possibility for producing a new commodity or producing an old one in a new way…To undertake such new things is difficult and constitutes a distinct economic function, first because they lie outside of the routine tasks which everybody understand, and secondly, because the environment resists in many ways."

Despite the Schumpeterian emphasis on the process of starting a new enterprise as the defining entrepreneurial activity, there is no generally accepted definition of entrepreneurship

for the developed countries of the OECD (OECD, 1998). The failure of a single definition of entrepreneurship to emerge undoubtedly reflects the fact that it is a multidimensional concept. The actual definition used to study or classify entrepreneurial activities reflects a particular perspective or emphasis. For example, definitions of entrepreneurship typically vary between the economic and management perspectives. From the economic perspective, Hebert and Link (1989) distinguish between the supply of financial capital, innovation, allocation of resources among alternative uses and decision-making. Thus, an entrepreneur is someone encompassing the entire spectrum of these functions: "The entrepreneur is someone who specializes in taking responsibility for and making judgemental decisions that affect the location, form, and the use of goods, resources or institutions" (Hebert and Link, 1989, p. 213).

By contrast, from the management perspective, Sahlman and Stevenson (1991, p.1) differentiate between entrepreneurs and managers in that, "entrepreneurship is a way of managing that involves pursuing opportunity without regard to the resources currently controlled. Entrepreneurs identify opportunities, assemble required resources, implement a practical action plan, and harvest the reward in a timely, flexible way."

The most prevalent and compelling views of entrepreneurship focus on the perception of new economic opportunities and the subsequent introduction of new ideas in the market. As Audretsch (1995) argues, entrepreneurship is about change, just as entrepreneurs are agents of change; entrepreneurship is thus about the process of change. This corresponds to the definition of entrepreneurship proposed by the OECD, "Entrepreneurs are agents of change and growth in a market economy and they can act to accelerate the generation, dissemination and application of innovative ideas….Entrepreneurs not only seek out and identify potentially profitable economic opportunities but are also willing to take risks to see if their hunches are right" (OECD, 1998, p. 11).

While the simplicity of defining entrepreneurship as activities fostering innovative change has its attraction, such simplicity also masks considerable complexity. Entrepreneurship is shrouded with complexity for at least two reasons. The first reason emerges because entrepreneurship is an activity crossing multiple organizational forms. Does entrepreneurship refer to the change inducing activities of individuals, groups of individuals such as networks, projects, lines of business, firms, and even entire industries, or even for geographic units of observation, such as agglomerations, clusters, and regions?

Part of the complexity involved with entrepreneurship is that it involves all of these types of organizational forms. No single organizational form can claim a monopoly on entrepreneurship.

The second source of complexity is that the concept of change is relative to some benchmark. What may be perceived as change to an individual or enterprise may not involve any new practice for the industry. Or, it may represent change for the domestic industry, but not for the global industry. Thus, the concept of entrepreneurship is embedded in the local context. At the same time, the value of entrepreneurship is likely to be shaped by the relevant benchmark. Entrepreneurial activity that is new to the individual but not the firm or industry may be of limited value. Entrepreneurial activity that is new to the region or country may be significant but ultimately limited. By contrast, it is entrepreneurial activity that is new across all organizational forms, all the way up to the global, that carries the greatest potential value.

Thus, one of the most striking features of entrepreneurship is that it crosses a number of key units of analysis. At one level, entrepreneurship involves the decisions and actions of individuals. These individuals may act alone or within the context of a group. At another level, entrepreneurship involves units of analysis at the levels of the industry, as well as at spatial levels, such as cities, regions and countries.

3. Globalization and the Strategic Management of Places

The role of entrepreneurship in society and has changed drastically over the last half century. During the post-World War II era, the importance of entrepreneurship and business seemed to be fading away. While alarm was expressed that small business needed to be preserved and protected for social and political reasons, few made the case on the grounds of economic efficiency. This position was drastically reversed in recent years. Entrepreneurship has become the engine of economic and social development throughout the world. The role of entrepreneurship has changed dramatically between the traditional and new economies.

During the post-war period a generation of scholars spanning a broad spectrum of academic fields and disciplines devoted their research to identifying the issues involving this perceived trade-off between economic efficiency on the one hand and political and economic decentralization on the other. Scholars responded by producing a massive literature focusing on essentially three issues: (i)What are the gains to size and large-scale production? (ii) What are the economic welfare implications of having an oligopolistic market structure, i.e. is economic performance promoted or reduced in an industry with just a handful of large-scale firms? and (iii) Given the overwhelming evidence that large-scale production resulting in economic concentration is associated with increased efficiency, what are the public policy implications?

This literature produced a series of stylized facts about the role of SMEs during the post-war economies in North America and Western Europe:

(1) *SMEs were generally less efficient than their larger counterparts*. Studies from the U.S. in the 1960s and 1970 revealed that SMEs produced at lower levels of efficiency, leading Weiss (1976, p. 259) to conclude that, “On the average, about half of total shipments in the industries covered are from suboptimal plants. The majority of plants in most industries are suboptimal in scale, and a very large percentrage of output is from suboptinal

plants." Pratten (1971) found similar evidence for the United Kingdom, where suboptimal scale establishments accounted for 47.9 percent of industry shipments.

(2) *SMEs provided lower levels of employee compensation*. Empirical evidence from both North America and Europe found a systematic and positive relationship between employee compensation and firm size (Brown, Hamilton and Medoff, 1990 and Brown and Medoff, 1989).

(3) *SMEs were only marginally involved in innovative activity*. Based on R&D measures, SMEs accounted for only a small amount of innovative activity.

(4) The relative importance of SMEs was declining over time in both North America and Europe

In the post-war era, small firms and entrepreneurship were viewed as a luxury, perhaps needed by the west to ensure a decentralization of decision making, but in any case obtained only at a cost to efficiency. Certainly the systematic empirical evidence, gathered from both Europe and North documented a sharp trend towards a decreased role of SMEs during the post-war period.

Thus, it was particularly startling and a seeming paradox, when scholars first began to document that what had seemed like the inevitable demise of SMEs actually began to reverse itself starting in the 1970s. Loveman and Sengenberger (1991) and Acs and Audretsch (1993) carried out systematic international studies examining the re-emergence of SMEs and entrepreneurship in North America and Europe. Two major findings emerged from these studies – first, the relative role of SMEs varies systematically across countries, and secondly, in most European countries and in North America, SMEs began increasing their relative

importance starting in the mid-1970s. In the U.S. the average real GDP per firm increased by nearly two-thirds between 1947 and 1980, from $150,000 to $245,000, reflecting a trend towards larger enterprises and a decreasing importance of SMEs. However, within the subsequent seven years, by 1987, it had fallen by about 14 percent to $210,000, reflecting a sharp reversal of this trend and the re-emergence of SMEs (Brock and Evans, 1989). Similarly, SMEs accounted for one-fifth of manufacturing sales in the U.S. in 1976, but by 1986 the small-firm share of sales had risen to over one-quarter (Acs and Audretsch, 1990).

The reversal of the trend towards large enterprises towards the re-emergence of SMEs was not limited to North America. In fact, a similar trend was found to take in Europe as well. For example, in the Netherlands the business ownership rate fell during the post-war period, until it reached a trough of 0.085 in 1982. But this downward trend was subsequently reversed, rising to a business ownership rate of 0.10 by 1998 (Audretsch et al., 2002). Similarly, the small-firm employment share in manufacturing in the Netherlands increased from 68.3 percent in 1978 to 71.8 percent in 1986; in the United Kingdom from 30.1 percent in 1979 to 39.9 percent by 1986; in (West) Germany from 54.8 percent in 1970 to 57.9 percenty by 1987; in Portugal from 68.3 percent in 1982 to 71.8 percent in 1986; in the North of Italy from 44.3 percent in 1981 to 55.2 percent by 1987, and in the South of Italy from 61.4 percent in 1981 to 68.4 percent by 1987 (Acs and Audretsch, 1993). An EIM documents how the relative importance of SMEs in Europe (19 countries), measured in terms of employment shares has continued to increase between 1988 and 2001 (EIM, 2002b).

As the empirical evidence mounted documenting the re-emergence of entrepreurship as a vital factor, scholars began to look for explanations and to develop a theoretical basis. The early explanations (Brock and Evans, 1989) revolved around six hypotheses:

1. That technological change had reduced the extent of scale economies in manufacturing

2. Increased globalization had rendered markets more volative as a result of competition from a greater number of foreign rivals

3. The changing composition of the labor force, towards a greater participation of females, immigrants, and young and old workers may be more conducive to smaller rather than larger enterprises, due to the greater premium placed on work flexibility

4. A proliferation of consumer tastes away from standardized mass-produced goods towards stylized and personalized products facilitates niche small producers

5. Deregulation and privatization facilitate the entry of new and small firms into markets that were previously protected and inaccessible

6. The increased importance of innovation in high-wage countries has reduced the relative importance of large-scale production and instead fostered the importance of entrepreneurial activity.

More recently, Audretsch and Thruik (2001) have deveoped the explanation for the re-emergence of entrepreneurship in Europe and North America based on increased globalization, which has shifted the comparative advantage towards knowledge-based economic activity. Conventional wisdom would have predicted that increased globalization would present a more hostile environment to small business (Vernon, 1970). Caves (1982) argued that the additional costs of globalization, that would be incurred by small business "constitute an important reason for expecting that foreign investment will be mainly an activity of large firms.

Certainly the empirical evidence by Horst (1972) showed that even after controlling for industry effects, the only factor significantly influencing the propensity to engage in foreign direct investment was firm size. As Chandler (1990) concluded, "to compete globally

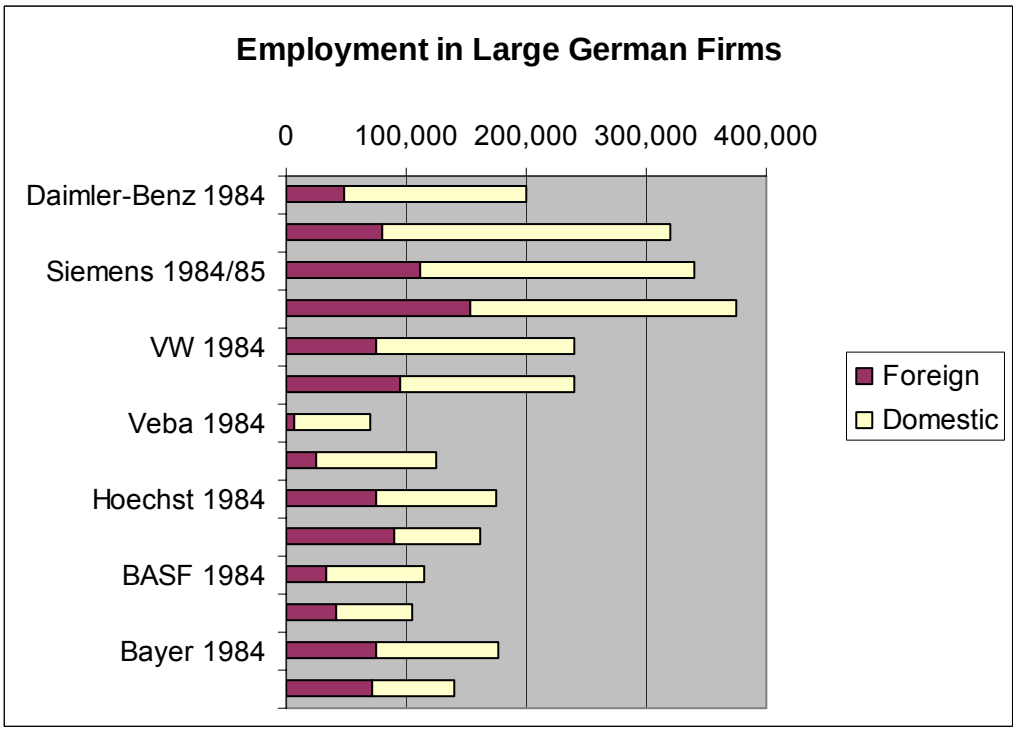
you have to be big." Gomes-Casseres (1997, p. 33) further observed that, "[s]tudents of international business have traditionally believed that success in foreign markets required large size. Small firms were thought to be at a disadvantage compared to larger firms, because of the fixed costs of learning about foreign environments, communicating at long distances, and negotiating with national governments."

According to Audretsch and Thurik (2001), SMEs did not become obsolete as a result of globalization, but rather their role changed as the comparative advantage has shifted towards knowledge-based economic activity. This has occurred for two reasons. First, large enterprises in traditional manufacturing industries have lost their competitiveness in producing in the high-cost domestic countries. Second, small entrepreneurial enterprises take on a new importance and value in a knowledge-based economy.

The loss of competitiveness by large-scale producers in high-cost locations is manifested by the fact that, confronted with lower cost competition in foreign locations, producers in the high-cost countries have three options apart from doing nothing and losing global market share: (1) reduce wages and other production costs sufficiently to compete with the low-cost foreign producers, (2) substitute equipment and technology for labor to increase productivity, and (3) shift production out of the high-cost location and into the low-cost location.

Many of the European and American firms that have successfully restructured resorted to the last two alternatives. Substituting capital and technology for labor, along with shifting production to lower-cost locations has resulted in waves of *Corporate Downsizing* throughout Europe and North America. At the same time, it has generally preserved the viability of many of the large corporations.

The experience has not been different in Europe. Pressed to maintain competitiveness in traditional industries, where economic activity can be easily transferred across geographic space to access lower production costs, the largest and most prominent German companies have deployed two strategic responses. The first is to offset greater wage differentials between Germany and low-cost locations by increasing productivity through the substitution of technology and capital for labor. The second is to locate new plants and establishments outside of Germany. What both strategic responses have in common is that the German flagship companies have been downsizing the amount of employment in the domestic economy. For example, Siemens increased the amount of employment outside Germany by 50 percent, from 108,000 in 1984/85 to 162,000 in 1994/95. Over the same time period it decreased the amount of employment in Germany by 12 percent, from 240,000 to 211,000.Volkswagen increased the amount of employment in foreign countries by 24 percent, from 78,000 in 1984 to 97,000 in 1994. Over the same time period, it decreased employment in Germany by 10 percent, from 156,000 to 141,000. Similarly, Hoechst increased the number of jobs outside of Germany by 9 percent, from 78,925 in 1984 to 92,333 in 1994. The number of Hoechst employees in Germany fell over that same period by 26 percent, from 99,015 to 73,338. And BASF increased employment in foreign countries by 34 percent, from 29,966 in 1984 to 40,297 in 1994. Domestic employment by BASF fell by 17 percent over that same time period, from 85,850 to 65,969.



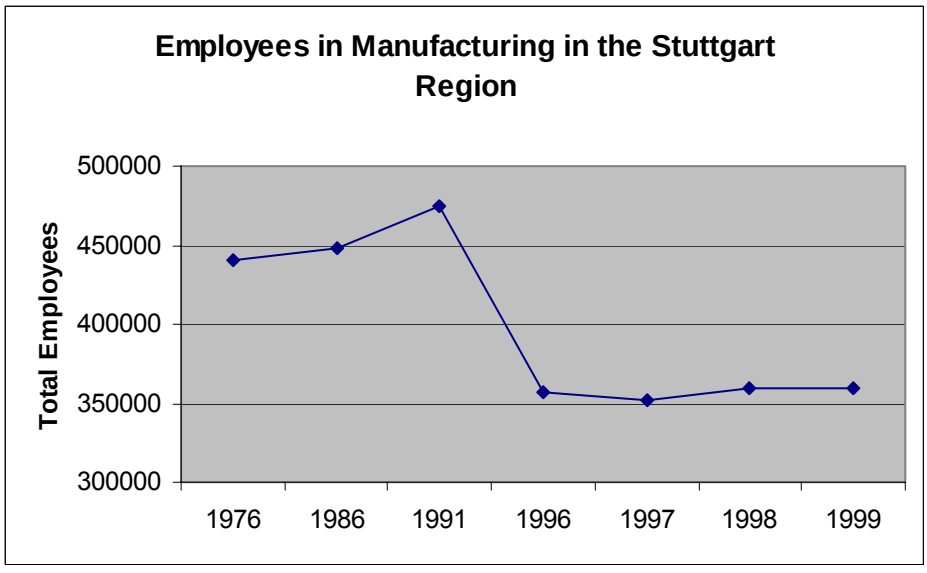
These examples are not isolated but rather typical of the wave of downsizing in Germany in the 1990s that has resulted in levels of unemployment – four million -- not seen since the Second World War. As Table 1 shows, between 1991 and 1995 manufacturing employment in German plants decreased by 1,307,000 while it increased in foreign subsidiaries by 189,000 (BMWi, 2000). In the chemical sector, the decrease of domestic employment was 80,000, while 14,000 jobs were added by German chemical companies in plants located outside of Germany. In electrical engineering employment in German plants decreased by 198,000. In automobilies employment in Germany decreased by 161,000, while 30,000 jobs were added outside of Germany.

Table 1: Change in employment figures in western Germany and at foreign subsidiaries (1991-1995, in thousands)

Employment trend	**Manufacturing**	**Chemicals**	**Electrical Engineering**	**Automotive**	**Mechanical Engineering**	**Textiles**	**Banking and insurance**
Foreign	**+ 189**	**+ 14**	**- 17**	**+ 30**	**+ 16**	**- 6**	**+ 21**
Domestic (west)	**- 1.307**	**- 80**	**- 198**	**- 161**	**- 217**	**- 68**	**+ 28**

Source: BMWi (2000)

The German impact of corporate downsizing in Germany in the 1990s was registerd not just by individual firms and industries but also by particular regions. For example, Stuttgart, which is home to Daimler-Chrysler (at the time Daimler-Benz), experienced an increase in manufacturing employment throughout the 1970s, 1980s, and into the 1990s. After reaching a peak of around 480,000 in 1991, manufacturing employment fell by more than one-third, to around 350,000 by the mid-1990s.



This wave of corporate downsizing triggered cries of betrayal and lack of social conscience on the part of the large corporations.[1] But it was a mistake to blame the corporations for this wave of downsizing that has triggered massive job losses and rising unemployment in so many countries. These corporations were simply trying to survive in an economy of global competitors who have access to lower cost inputs.

Much of the policy debate responding to the twin forces of the telecommunications revolution and increased globalisation revolved around a perceived trade-off between maintaining higher wages but suffering greater unemployment versus higher levels of employment but at the cost of lower wage rates. There is, however, an alternative. It does not require sacrificing wages to create new jobs, nor does it require fewer jobs to maintain wage levels and the social safety net. This alternative involves shifting economic activity out of the traditional industries where the high-cost countries of Europe and North America have lost the comparative advantage and into those industries where the comparative advantage is compatible with both high wages and high levels of employment – knowledge based economic activity.

Globalization has rendered the comparative advantage in traditional moderate technology industries incompatible with high wage levels. At the same time, the emerging comparative advantage that is compatible with high wage levels is based on innovative activity. Thus, the regional response to globalization has been the emergence of strategic management policy – not for firms, but for places. As long as corporations were inextricably linked to their regional location by substantial sunk costs, such as capital investment, the competitiveness of a region was identical to the competitiveness of the corporations located in

[1] As the German newspaper, *Die Zeit* (2 February, 1996, p. 1) pointed out in a front page article, "When Profits Lead to Ruin – More Profits and More Unemployment: Where is the Social Responsibility of the Firms?" the German public has responded to the recent waves of corporate downsizing with accusations that corporate Germany is no longer fulfilling its share of the social contract.

that region. A quarter century ago, while the proclamation, "What is good for General Motors is good for America" may have been controversial, few would have disagreed that "What is good for General Motors is good for Detroit." And so it was with U.S. Steel in Pittsburgh and Volkswagen in Wolfsburg. As long as the corporation thrived, so would the region.

As globalization has rendered not only the degree to which the traditional economic factors of capital and labor are sunk, but also shifted the comparative advantage in the high-wage countries of North America and Europe towards knowledge-based economic activity, corporations in traditional industries have been forced to shift production to lower-cost locations. This has led to a de-linking between the competitiveness of firms and regions. The advent of the strategic management of regions has been a response to the realization that the strategic management of corporations includes a policy option not available to regions – changing the production location.

4. The Emergence of Entrepreneurship Policy

During the Post World War II era, there was considerable concern about what to do about the existing firms and industrial structure, but little attention was paid to where they came from and where they were going (Audretsch and Thurik, 2001). Oliver Williamson's classic 1968 article "Economies as an Antitrust Defense: The Welfare Tradeoffs," became something of a final statement demonstrating what appeared to be an inevitable trade-off between the gains in productive efficiency that could be obtained through increased concentration and gains in terms of competition, and implicitly democracy, that could be achieved through decentralizing policies. But it did not seem possible to have both, certainly not in Williamson's completely static model.

The fundamental policy issue confronting Western Europe and North America during the post-war era was how to live with this apparent trade-off between concentration and

efficiency on the one hand, and decentralization and democracy on the other. The public policy question of the day was, *How can society reap the benefits of the large corporation in an oligopolistic setting while avoiding or at least minimizing the costs imposed by a concentration of economic power?* The policy response was to constrain the freedom of firms to contract. Such policy restraints typically took the form of public ownership, regulation and competition policy or antitrust. At the time, considerable attention was devoted to what seemed like glaring differences in policy approaches to this apparent trade-off by different countries. France and Sweden resorted to government ownership of private business. Other countries, such as the Netherlands and Germany, tended to emphasize regulation. Still other countries, such as the Untied States, had a greater emphasis on antitrust. In fact, most countries relied upon elements of all three policy instruments. While the particular instrument may have varied across countries, they were, in fact, manifestations of a singular policy approach – how to restrict and restrain the power of the large corporation. What may have been perceived as a disparate set of policies at the time appears in retrospect to comprise a remarkably singular policy approach (Audretsch and Thurik, 2001).

In Europe Servan-Schreiber warned of the "American Challenge" in the form of the "dynamism, organization, innovation, and boldness that characterize the giant American corporations" (1968, p. 153). Because giant corporations were considered to be the engine of growth and innovation, Servan-Schreiber advocated the "creation of large industrial units which are able both in size and management to compete with the American giants" (1968, p. 159). According to Servan-Schreiber (1968, p. 159), "The first problem of an industrial policy for Europe consists in choosing 50 to 100 firms which, once they are large enough, would be the most likely to become world leaders of modern technology in their fields. At the moment we are simply letting industry be gradually destroyed by the superior power of American

corporations." Ironically, the 1988 Cecchini Report identified the gains from European integration as largely accruing from increases in scale economies.

Public policy towards SMEs was oriented towards preserving what was considered to be inefficient enterprises, which, if left unprotected, might otherwise become extinct. Preservationist policies were clearly at work in the creation of the U.S. Small Business Administration. In the Small Business Act of July 10, 1953, Congress authorized the creation of the Small Business Administration, with an explicit mandate to "aid, counsel, assist and protect…the interests of small business concerns."[2] The Small Business Act was clearly an attempt by the Congress to halt the continued disappearance of small businesses and to preserve their role in the U.S. economy

By contrast, entrepreneurship policy is a relatively new phenomenon. An important distinction should be made between the traditional SME (small business) policies and entrepreneurship policies. SME policy typically refers to policies implemented by a ministry or government agency charged with the mandate to promote SMEs. The actual definition of SMEs varies considerably across countries, ranging from enterprises with fewer than 500 employees in some of the most developed countries, such as the United States and Canada, to fewer than 250 employees in the European Union, to 50 employees in many developing countries. The actual SME policy takes the existing enterprises within the appropriate size class as exogenous, or given, and then develops instruments to promote the viability of those enterprises. Thus, SME policy is almost exclusively targeted towards the existing stock of enterprises and virtually all of the instruments included in the policy portfolio are designed to promote the viability of the SMEs.

By contrast, entrepreneurship policy has a much broader focus. The definition introduced by Lundstrom and Stevenson (2001, p. 19) for OECD countries is certainly

[2] http://www.sba.gov/aboutsba/sbahistory.html

applicable in the context of the European Union, "Entrepreneurship policy consists of measures taken to stimulate more entrepreneurial behavior in a region or country…We define entrepreneurship policy as those measures intended to directly influence the level of entrepreneurial vitality in a country or a region."

There are at least two important ways that distinguish entrepreneurship policy from SME policy (Lundstrom and Stevenson, 2002). The first is the breadth of policy orientation and instruments. While SME policy has a focus on the existing stock of SMEs, entrepreneurship policy is more encompassing in that it includes potential entrepreneurs as well as the existing stock of SMEs. This suggests that entrepreneurship policy is more focused on the process of change, regardless of the organizational unit, whereas SME policy is focused exclusively on the enterprise level. Entrepreneurship policy also has a greater sensitivity to framework or environmental conditions that shape the decision-making process of entrepreneurs. While SME policy is primarily concerned with one organizational level – the enterprise, entrepreneurship policy encompasses multiple units of organization and analysis. These range from the individual to the enterprise, and to the cluster or network, which might involve an industry or sectoral dimension, or a spatial dimension, such as a district, city, region, or even an entire country. Just as each of these levels is an important target for policy, the interactions and linkages across these disparate levels are also important. In this sense, entrepreneurship policy tends to be more systemic than SME policy. However, it is important to emphasize that SME policy still remains at the core of entrepreneurship policy.

The second way distinguishing entrepreneurship policy from traditional SME policy is that virtually every country has a ministry or governmental agency charged with promoting the viability of the SME sector. These ministries and agencies have by now developed a well established arsenal of policy instruments to promote SMEs. However, no such agencies exist

to promote entrepreneurship. Part of the challenge of implementing entrepreneurship policy is that no country has yet to introduce an agency mandated with the charge of promoting entrepreneurship. Rather, aspects relevant to entrepreneurship policy can be found across a broad spectrum of ministries and agencies, ranging from education to trade and immigration. Thus, while SMEs have agencies and ministries that champion their issues, no analogous agency exists for entrepreneurship policy.

Just because entrepreneurship is positively linked to performance does not automatically justify public policy intervention. Rather, the mandate for public policy intervention is the result of three fundamental sources of market failure – network externalities, knowledge externalities, and learning externalities.

Network externalities result from the value of an individual's or firm's capabilities being conditional upon the geographic proximity of complementary firms and individuals. As Porter (2000) pointed out, local proximity is essential for accessing these knowledge spillovers. This makes the value of an entrepreneurial firm greater in the (local) presence of other entrepreneurial firms. The value of any individuals or firms capabilities is therefore conditional upon the existence of partners in a network Firms and workers place a greater value on locations within clusters which contain complementary workers and firms than on those outside of clusters. Such market failure can occur where there is a potential for geographic clustering, sectoral linkages, or networks.

The second source of market failure involves knowledge externalities. As Arrow (1962) documented, knowledge, which involves new ideas, is inherently a public good, so that its production generates externalities. However, as Porter (2000) pointed out, local proximity is essential for accessing these knowledge spillovers.

The second source of market failure emanating from entrepreneurship is that positive economic value for third-party firms and individuals is created even in entrepreneurial firms that fail. The high failure rate of new-firm startups has been widely documented and described above in this paper, and the failure rates in knowledge-based activities are especially great. This is not surprising since knowledge activities are associated with a greater degree of uncertainty. However, the failure of a knowledge-based firm does not imply no value was created by the firm; evidence suggests that ideas created by failed firms and projects often become integral parts of successful products and projects in successful firms.

The externalities sometimes associated with failed firms, also creates a market failure in the valuation of (potential) new enterprises by private investors and policy makers. Whereas the private investor can only appropriate her investment if the particular firm succeeds, a failed firm that generates positive externalities contributes to the success of other third-party firms. The private investor, however, does not appropriate anything from the original investment. Likewise, individual firms and workers would have no incentive to invest in the development of a cluster, which is the creation of other entrepreneurial firms, due to their inability to appropriate returns from such a cluster.

From the public policy perspective, on the other hand, it does not matter which firm succeeds, as long as some firm(s) do, and growth, along with the other benefits accruing from entrepreneurship, is generated for the locale.

The third source of market failure involves the learning or demonstration effect emanating from entrepreneurial activity. This is particularly valuable in regions where entrepreneurship has been noticeably absent and no strong entrepreneurial traditions exist. Entrepreneurial activity involves not just the firm or individual responsible. Rather, others will observe this activity and the results of entrepreneurship. Other people will learn that entrepreneurship is a viable alternative to the status quo. As a result of this demonstration

effect, others will be induced to also develop entrepreneurial strategies. Thus, there is a strong and compelling positive externality associated with entrepreneurship, particularly in areas with no strong entrepreneurial traditions.

Thus, the market failures inherent in entrepreneurship – network externalities, knowledge externalities and demonstration or learning externalities --result in a gap in the valuation of entrepreneurial activities between private parties and the local public policy makers. Entrepreneurial activity, combined with the propensity for knowledge to remain localized, results in a new policy mandate for cities, regions, provinces and countries. It also results in a fundamental mandate for the role to serve as a partner to business, enabling and fostering the development of new and small entrepreneurial firms. By filling these gaps left by market failure, public policy can create a virtuous entrepreneurial circle, where entrepreneurs become networked and linked to each other, and strong role models of entrepreneurship exist for others to emulate.

As the comparative advantage has become increasingly based on new knowledge, public policy has responded in two fundamental ways. The first has been to shift the policy focus away from the traditional triad of policy instruments essentially constraining the freedom of firms to contract – regulation, competition policy or antitrust in the U.S., and public ownership of business. The policy approach of constraint was sensible as long as the major issue was how to restrain large corporations in possession of considerable market power. That this policy is less relevant in a global economy is reflected by the waves of deregulation and privatization throughout Europe and North America. Instead, a new policy approach is emerging which focuses on enabling the creation and commercialization of knowledge. Examples of such policies include encouraging R&D, venture capital and new-firm startups.

While the different types of entrepreneurship policies being implemented in the EU and US are two numerous to be identified and listed here, David Storey (2003) has identified examples of different types of entrepreneurship policies being undertaken in the EU and the U.S. In addition, he provides an assessment of the efficacy of the various types of policies undertaken. Illustrations of these policies are provided in Table 1.

Table 1: Illustrations of Entrepreneurship Policies

Problem	**Programme**	**Description**	**Country**	**Success**
Access to Loan Finance	Loan Guarantee Scheme	SMEs without access to own collateral obtain access to bank loans by state acting as guarantor	UK USA Canada France Netherlands	Yes, generally viewed as helpful, but small scale impact on the overall financing of SMEs in most countries
Access to Equity Capital	Enterprise Investment Scheme	Tax breaks for wealthy individuals to become business angels	UK	Unknown
Access to Markets	Europartenariat	Organisation of Trade Fairs to encourage cross-border trade between SMEs	EU	General satisfaction amongst firms that participated
Administrative Burdens	Units established within government to seek to minimise administrative burdens on smaller firms	Sunsetting Legislation deregulation Units	Netherlands Portugal, UK	The view of small firms themselves is that bureaucratic burdens have increased markedly in recent years
.Science Parks	Property based developments adjacent to Universities	Seek to promote clusters of new technology based firms	UK, France, Italy and Sweden	Conflicting findings on impact of SPs on performance of firms
. Managed Workspace	Property provision to assist new and very small firms	Often called business incubators, these provide premises for new and small firms on "easy- terms"	World-wide	General recognition that such initiatives are of value
. Stimulating Innovation and R&D in small firms	Small Business Innovation Research Program	$1 billion per year is allocated via a competition to small firms to stimulate additional R&D activity	USA	Lerner implies SBIR enhances small firm performance, but Wallsten is unable to show it leads to additional R&D
. Stimulating Training in small firms	Japan Small Business Corporation (JSBC)	JSBC and local governments provide training for owners and managers of small firms. The training programme began in 1963	Japan	Unknown
Entrepreneurial Skills	Small Business Development Corporations (SBDCs)	Counselling is provided by SBDC mentors to small business clients who may be starting a business or be already trading	USA	This study finds SBDC clients have higher rates of survival and growth than might be expected. Reservations over these findings are found in the text
. Entrepreneurial Awareness	Entrepreneurship Education	To develop an awareness of enterprise and/or an entrepreneurial spirit in society by incorporating enterprise into the school and college curriculum	Australia, Netherlands, but leading area was Atlantic Canada	Conventional assessments are particularly difficult here because of the long "lead times"
. Special Groups	Law 44	Provides finance and mentoring advice to young people in Southern Italy, where enterprise creation rates were very low	Southern Italy	This is an expensive programme, but most studies show the survival rates of assisted firms to be well above those of "spontaneous" firms

Source: Table taken (modified) from Storey (2003)

The policy shift to enabling the creation and viability of knowledge-based entrepreneurial firms is evidenced by passage by the United States Congress of the Small

Business Innovation Research (SBIR) program in the early 1980s. Enactment of the SBIR was a response to the loss of American competitiveness in global markets. Congress mandated each federal agency with allocating around four percent of its annual budget to funding innovative small firms as a mechanism for restoring American international competitiveness (Wessner, 2000). The SBIR provides a mandate to the major R&D agencies in the United States to allocate a share of the research budget to innovative small firms. In 2001 the SBIR program amounted to around $1.4 billion. The SBIR consists of three phases. Phase I is oriented towards determining the scientific and technical merit along with the feasibility of a proposed research idea. A Phase I award provides an opportunity for a small business to establish the feasibility and technical merit of a proposed innovation. The duration of the award is six months and can not exceed $70,000. Phase II extends the technological idea and emphasizes commercialization. A Phase II Award is granted to only the most promising of the Phase I projects based on scientific/technical merit, the expected value to the funding agency, company capability and commercial potential. The duration of the award is a maximum of 24 months and generally does not exceed $600,000. Approximately 40 percent of the Phase I Awards continue on to Phase II. Phase III involves additional private funding for the commercial application of a technology. A Phase III Award is for the infusion and use of a product into the commercial market. Private sector investment, in various forms, is typically present in Phase III. Under the Small Business Research and Development Enhancement Act of 1992, funding in Phase I was increased to $100,000, and in Phase II to $750,000.

The SBIR represents about 60 percent of all public entrepreneurial finance programs. Taken together, the public small-business finance is about two-thirds as large as private venture capital. In 1995, the sum of equity financing provided through and guaranteed by public programs financing SMEs was $2.4 billion, which amounted to more than 60 percent

of the total funding disbursed by traditional venture funds in that year. Equally as important, the emphasis on SBIR and most public funds is on early stage finance, which is generally ignored by private venture capital. Some of the most innovative American companies received early stage finance from SBIR, including Apple Computer, Chiron, Compaq and Intel.

There is compelling evidence that the SBIR program has had a positive impact on economic performance in the U.S. (Wessner, 2000; Lerner, 1999). The benefits have been documented as:

- The survival and growth rates of SBIR recipients have exceeded those of firms not receiving SBIR funding

- The SBIR induces scientists involved in biomedical research to change their career path. By applying the scientific knowledge to commercialization, these scientists shift their career trajectories away from basic research towards entrepreneurship.

- The SBIR awards provide a source of funding for scientists to launch start-up firms that otherwise would not have had access to alternative sources of funding.

- SBIR awards have a powerful demonstration effect. Scientists commercializing research results by starting companies induce colleagues to consider applications and the commercial potential of their own research.

Sternberg (1996) has shown that a number of government-sponsered technology policies in four countries – Great Britain, Germany, the U.S. and Japan, has triggered the startup of new firms. The majority of the startup programs are targeted towards eliminated particular bottlenecks in the development and financing of new firms. Sternberg (1990) examines the impact that 70 innovation centers have had on the development of technology-

based small firms. He finds that the majority of the entrepreneurs find a number of advantages from locating at an innovation center.

The second fundamental shift involves the locus of such enabling policies, which are increasingly at the state, regional or even local level. The downsizing of federal agencies charged with the regulation of business in many of the OECD countries has been interpreted by many scholars as the eclipse of government intervention. But to interpret deregulation, privatisation and the increased irrelevance of competition policies as the end of government intervention in business ignores an important shift in the locus and target of public policy. The last decade has seen the emergence of a broad spectrum of enabling policy initiatives that fall outside of the jurisdiction of the traditional regulatory agencies. Sternberg (1996) documents how the success of a number of different high-technology clusters spanning a number of developed countries is the direct result of enabling policies, such as the provision of venture capital or research support. For example, the Advanced Research Program in Texas has provided support for basic research and the strengthening of the infrastructure of the University of Texas, which has played a central role in developing a high-technology cluster around Austin (Feller, 1997). The Thomas Edison Centers in Ohio, the Advanced Technology Centers in New Jersey, and the Centers for Advanced Technology at Case Western Reserve University, Rutgers University and the University of Rochester have supported generic, precompetitive research. This support has generally provided diversified technology development involving a mix of activities encompassing a broad spectrum of industrial collaborators. the Edison Technology Program of Ohio was established by the State of Ohio, as a means of transferring technology from universities and government research institutes to new firm startups. Carlsson and Brunerhjelm (1999) explain how the Edison BioTechnology Center serves an important dual role as a “bridging institution” between academic research and industry and between new startups and potential sources of finance. The Edison Centers

in particular, try to link the leading universities and medical institutions, businesses, foundations, to civic and state organizations in Ohio in order to create new business opportunities. Numerous centers exist across the state. Similarly, the Edison Program has established a bridging institution to support polymer research and technology in Ohio. Carlsson and Brunerhjelm (1999) credit the program for the startup of new high technology firms in Ohio.

Other examples of enabling policies are evidenced by the plethora of science, technology and research parks. Lugar and Goldstein (1991) conducted a review of research parks and concluded that such parks are created in order to promote the competitiveness of a particular region. Lugar (2001, p. 47) further noted that, "The most successful parks…have a profound impact on a region and its competitiveness." A distinct exemplar of this effect is found in the Research Triangle Park in North Carolina.

The traditional industries in North Carolina - furniture, textiles, and tobacco - had all lost international competitiveness, resulting in declines in employment and stagnated real incomes. In 1952, only Arkansas and Mississippi had lower per capita incomes. According to Link and Scott (forthcoming, p. 2), a movement emerged to use the rich knowledge base of the region, formed by the three major universities – Duke University, University of North Carolina-Chapel Hill and North Carolina State. This movement, though it initially consisted only of businessmen looking to improve industrial growth, ultimately fell into the hands of the Governor's office, who supported the efforts through fruition (Link, 1995). Empirical evidence provides strong support that the initiative creating Research Triangle has led to fundamental changes in the region. Link and Scott (forthcoming), document the growth in the number of research companies in the Research Triangle Park as increasing from none in 1958 to 50 by the mid-1980s and to over 100 by 1997. At the same time, employment in these research companies increased from zero in the late 1950s to over 40,000 by 1997. Lugar

(2001) attributes the Research Triangle Park with directly and indirectly generating one-quarter of all jobs in the region between 1959 and 1990, and shifting the nature of those jobs towards high value-add knowledge activities.

Such enabling policies are not restricted to the U.S. One of the most interesting examples of the new enabling entrepreneurship policy involves the establishment of five EXIST regions in Germany, where startups from universities and government research laboratories are encouraged (BMBF, 2000). The program has the explicit goals of (1) creating an entrepreneurial culture, (2) the commercialization of scientific knowledge, and (3) increasing the number of innovative start-ups and SMEs. Five regions were selected among many applicants for START funding. These are the (1) Rhein-Ruhr region (bizeps program), (2) Dresden (Dresden exists), (3) Thueringen (GET UP), (4) Karlsruhe (KEIM), and (5) Stuttgart (PUSH!).

These programs promoting entrepreneurship in a regional context are typical of the new enabling policies to promote entrepreneurial activity. While these entrepreneurial policies are clearly evolving, they are clearly gaining in importance and impact in the overall portfolio of economic policy instruments.

5. Conclusions

Globalization has shifted the comparative advantage in the OECD countries away from being based on traditional inputs of production, such as land, labor and capital, towards knowledge. This has triggered a divergence between the competitiveness of firms and the competitiveness of locations. As the strategic management of firms dictated a response to globalization of outward foreign direct investment combined with employment downsizing at high cost locations, public policy has responded by developing the strategic management of places. Policy to promote entrepreneurship has emerged as playing a central role in the strategic

management of places, because entrepreneurial activity is the conduit between investments in knowledge and economic growth at the particular location. However, due to the two sources of market failure associated with investments in knowledge and entrepreneurial activity identified in this paper, private agents will tend to underinvest in entrepreneurial activity. A major goal of the strategic management of places is to pursue policies that will compensate for this market failure by promoting knowledge-based entrepreneurship as a vehicle for the employment growth and global competitiveness.

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Global startups and the role of universities

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Introduction

Entering global market has long been thought of as a business activity of large companies rather than of startups. Indeed not many young companies venture abroad in the early stages of their existence. Yet for startups in certain emerging (technological) sectors, globalisation is inevitable, and offers interesting opportunities. It is inevitable because high R&D expenditure can rarely be compensated by sales in the domestic market alone; finding foreign customers is therefore essential. Globalisation is also inevitable since in many technological sectors the necessary resources and potential partners are scarcely available and scattered around the globe. By combining such international resources and working with international partners startups can create products and services with a high added value. Early internationalisation or even a real global startup has become possible because technological innovations such as the Internet facilitate international activities and reduce its costs to a great extent. Moreover, increasingly, highly educated and well-travelled entrepreneurs possess the skills and the vision necessary to be internationally active. Early stage internationalisation therefore seems to be a logical consequence of starting a high tech venture. Still, only a small portion of all

high tech startups can indeed be considered global startups. Others are not able to fulfil their global potential. From experiences with 'traditional' spin-off programmes, such as the University of Twente's Temporary Entrepreneurial Programme (Van der Sijde, Ridder, Van Benthem & Groen, 2002) and the GlobalStart project (EU-Paxis; IPS 2001 41038) we know that universities can and do play an important role in the creation and stimulation of international new ventures and in the facilitation of their development and reaching their full global potential. In this paper we explore how universities can do this.

Characterising a Global Startup Company

Based on our previous work (Wakkee, Kirwan and van der Sijde 2004, Wakkee, 2004) we introduce ten characteristics outlining what constitutes a global startup company.

Characteristic 1: Global Startups often begin international activities even before the start of the actual (sales) operations. Evidence from our previous work shows that global startups engage in global activities during their startup period. Global startup companies tend to initiate activities involving foreign counterparts to identify and develop ideas, gain information, assemble resources and set up joint R&D or production activities, often even before the first sale has been closed or even before the firm is officially founded. In our perspective, this characteristic differentiates global startups from born global firms. ;A born global firm has been described as a firm which begins international sales during its startup period and which develops these activities over time (e.g. Knight, 1997, Harveston, 2000) even if the activities remain limited to international sales in a small number of countries.

Characteristic 2: Global Startups engage in international activities to pursue opportunities. Another characteristic of global startup firms is their entrepreneurial nature. This entrepreneurial nature is a reflection on the ability of the global startup to recognise and

exploit opportunities wherever they arise across the globe. Global startup firms proactively create and pursue opportunities regardless of international borders whereas the international activities of most other firms are initiated as a result of unsolicited orders from abroad. Also, in our perspective building a competitive advantage – is often mentioned as the purpose for early internationalisation (e.g. McDougall et. al., 1994; Dominguinhos, 2001)- may not always be the goal of starting internationalisation early on. The reasons for this are that startup may not necessarily compare their performance to that of their competitors, and /or even because in emerging industries no competitive regime has yet been established.

Characteristic 3: Global Startups are involved in a wide range of formal and informal value-added activities across national borders. As previously mentioned, international sales are the most prevalent international activity mentioned in the literature (Rennie, 1993, Knight, 1997, Harveston, 2000, Rasmussen et. al., 2000). Interviews with entrepreneurs however revealed that although view sales as the most important international activity, case evidence showed that global startups typically are engaged in other cross border activities as well, e.g. collaborative R & D projects and utilising foreign (tangible and intangible) resources (Burgel & Murray, 1997). Given that the technology involved in many global start ups is so radically new, traditional marketing techniques may not suffice, firms have to employ new techniques to create awareness and acceptance of their products and many firms engage in cross border activities to achieve this.

Characteristic 4: Global Startups use a variety of formal and informal network entry modes across national borders. The concept entry mode is frequently used in relation to international sales (direct export, use of domestic or international agents, setting up sales offices abroad (e.g. Johanson & Wiedersheim-Paul, 1975, Cavusgil, 1980). For instance, a company can use direct sales, agents, local distributors, or a local sales subsidiary to enter

different markets. The cases show that the use of different entry modes is not limited to entering sales markets but more general to entering various international networks whether these are related to sales, R&D, production or simply the exchanges of ideas and information across national borders. From the cases it seems that global startups use entry modes that range from cross-border activities that are directed from the domestic market, the use of intermediaries (e.g. sales agents or distributors), partnerships (e.g. joint R&D) or setting up foreign subsidiaries either through Greenfield operations or joint ventures

Characteristic 5. Global Startups are active in a wide number of regions of the world. Global startup companies are truly globally active rather than 'merely' internationally active. With a few exceptions other authors have either not included a measure of global diversity at all (Cavusgil & Knight, 1996) or used a measure based on the number of countries (e.g. Kandasaami, 1998). However, in our view a firm that is active only in Europe even if it is active in 10 different countries in Europe can hardly be called a *global* startup. Case evidence shows that global startups are active in at least two regions, e.g. Europe and North America, while there is also evidence of companies active in Asia, the Middle East, Latin America, etc.

Characteristic 6: Global Startups internationalise their activities following the presence of opportunities rather than following a pattern of increasing physical and cultural distance. Most companies follow patterns of internationalisation of moving their international activities from their home countries to those that are physically and culturally close and then increasingly distant. This pattern of increasing psychic distance has often been used to describe internationalisation processes in traditional internationalisation literature (Johansson & Wiedersheim-Paul, 1979). In the literature on international new ventures (e.g. Rennie, 1993, McDougall et. al., 1994, Jones, 2001) as well as in our case studies, it has already been shown that international new ventures, including global startups do not follow such traditional

internationalisation patterns. Rather, reflecting the global vision of the founding entrepreneurs, global startups seek out and pursue opportunities wherever these exist and employ the same technique for their further internationalisation activities. That global startups follow these less traditional internationalisation patterns is sometimes borne out of necessity given that the opportunity do not exist on a local level.

Characteristic 7: Global Startups are not necessarily high growth companies. Despite not being explicitly mentioned in the definitions of global startup companies many authors (e.g. Jolly et al., 1992; Oviatt and McDougall, 1994; Zahra and George, 2002) put forward that global startups are high growth companies. Examining the empirical evidence does not present a compelling argument one-way or the other. While examples exist of companies who have experienced rapid growth, evidence also exists of startup companies who remain small in terms of number of employees, and whose founders indicated that they were not interested in running large multinational firms. These companies employ strategic actions to avoid rapid growth, e.g. through international strategic alliances they can attract customers they could never handle without engaging in expansion of the company. There is further evidence of companies spinning off new business units in preference of growing the original one. Further, the lack of growth in some cases is a reflection on the research-intensive nature of the business. For these firms the period between the initiation of business activities and the generation of profits may be extensive, growth might only start after a considerable number of years. From this it can be concluded that while high growth is a characteristic of certain global startups it is not necessarily a defining characteristic of all global startup firms.

Characteristic 8: Global startups are characterised by high levels of entrepreneurial orientation. The construct Entrepreneurial Orientation as developed by Lumpkin and Dess (e.g. Lumpkin and Dess, 1996, Lumpkin, 1998) was originally developed for more established

firms, to measure a firm's track record with regards to innovativeness, risk taking, proactiveness and competitive aggressiveness. However, case evidence from the literature indicates that considerably high levels of entrepreneurial orientation (EO) can also be identified in global startups. Global startup companies are highly innovative, this is reflected in the types of products/applications of technology that they develop, an example of the level of a company's innovativeness could be measured by the number of patents that that company owns. A further illustration of entrepreneurial orientation can be seen by those companies offering their technologies to other research groups at reduced market rates in return for academic output on the technologies. This proactive approach carries its own risk as some of the collaborating research institutes may become interested in entering the market themselves. However, this approach concurrently increases the innovative capacity of the firm as it reduces the need for investment in additional personnel or research facilities, while still affording the company the benefit from the outcomes of these external investigations. Whereas most high tech startups need to be innovative, proactive and risk taking in order to establish a position in the market, what makes global startups stand out is the fact that these firms also show these types of behaviour with respect to entering international markets.

Characteristic 9: Internationally skilled and confident entrepreneurs, who may or may not have actual international business experience, typically found Global Startups. The descriptions in the literature suggest that born globals, international new ventures, and global startups firms are typically founded by entrepreneurs with considerable experience and skill in international operations (McDougall, et.al. 1994, Oviatt & McDougall, 1999; Harveston, 2000). From the case descriptions it is evident that global startup companies are indeed founded and directed by a single entrepreneur or a team of entrepreneurs who strongly dominate the development of the company. The global vision associated with global startups is apparent in the founding entrepreneurs; from the beginning they identified the global nature

of their company's opportunity. They realised that on the one hand their products would offer added value to customers around the world and that on the other hand, global activities were essential in setting up these activities. However, from examination of case material considerable variety exists with respect to the international experience of the founding entrepreneur(ial) team. Many founders have considerable experience in living and working abroad which is deemed to have had an impact on the development of the company. Yet, at least as many founders of successful global startups do not possess first hand international experience. Many founding entrepreneurs have a background in academia, while these entrepreneurs are lacking international work experience in an industry context; Universities are highly international organisations where students, staff and faculty members from foreign countries visit regularly and these scholars are used to participating in international conferences. This international culture may give these entrepreneurs sufficient confidence in which to operate internationally. Also, the (non-American) entrepreneurs were able to communicate in foreign languages (typically English and one other language). This too provided them with the confidence to set up international operations.

Characteristic 10: Global Startups often rely on the relationship with a strong partner; this may be a commercial partner or a research institute. Although not identified in the literature the examples from the empirical investigation of the cases revealed one other important characteristic of global startups; in each of the cases the presence of a partner or network was a critical success factor. In many of the cases this partner was a research institute of a university or a financial investor/institution. In the cases these partners played an important role in providing the startup companies with access to such resources as finance, research facilities, intellectual property, etc., while also providing the new company with some legitimacy. For the startups it would have been very difficult or even impossible to obtain such resources on their own or by other means and without these the companies could

simply not exist. The presence of the strong partner has been seen to have positive effects in helping startups establish their organisation and customer base, providing mentoring and coaching for those starting entrepreneurs with limited business experience and improving the level of credibility of the starting firms. However, firms must develop their network sufficiently so as not to be over reliant on any one partner.

The university as a strong partner

In the characteristics many implicit and explicit references to "networks" are made. The network of a firm consists of many different types of actors (individuals and organizations). In this contribution we focus specifically on the role of the university in helping the firm coping with its challenges. The reason for this is that many technology-based firms originate from a university. They are often the result of commercialising research results and/or many companies are founded by (former) staff members of a university (Jones-Evans, 1995; Klofsten & Jones-Evans, 2000). Research shows that the parent organisation often plays a critical role in the development of their spin-off (Autio, 1997).

From an analysis of case studies on startup companies it can be seen that Global Startup companies usually have a relationship with one strong partner, e.g. university research group or a venture capitalist (Wakkee et al., 2004). This strong partner provides the new company with access to resources and information and also provides some legitimacy for the startup venture. Universities are often these "strong partners" and they have relationships with other support-offering actors (e.g. incubators, regional development agencies, etc.) and together these organisations can also support the new venture in their internationalisation and globalisation. In Figure 1 we present the expected starting position and development of the network of the potential global start up company. In the initial stage the firm has a strong relationship with an established player (strong partner) in the global market (black text). Over the course of time it is expected that this network will evolve into a situation where the tie

between the global start up company and its strong partner has lessened. At the same time the global start up company will have strengthened it's ties with the other global market players enabling it to realise its global potential. We will briefly illustrate this with a case taken from Wakkee (2004)

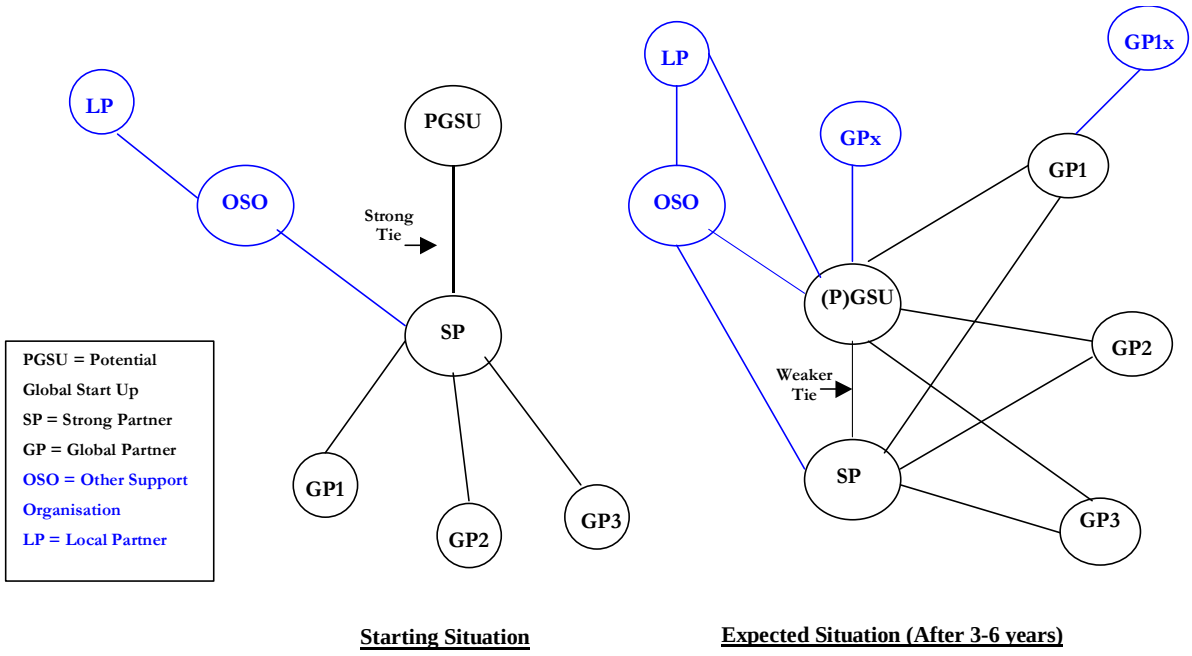

Figure 1: The development of the Global Start Ups' Network Over Time

Short profile of the company. X-Tech[3] was founded in 1998 by a researcher and a former business consultant. Its main products are sound measurement devices based on a radical new technology. Because of the highly specialized nature of the product, the company operates in a niche market and competes mainly with suppliers of traditional microphones. In fact creating awareness, understanding and acceptance of the technology is one of the key issues for this company. By 2003 the company has operations in more than 25 different countries.

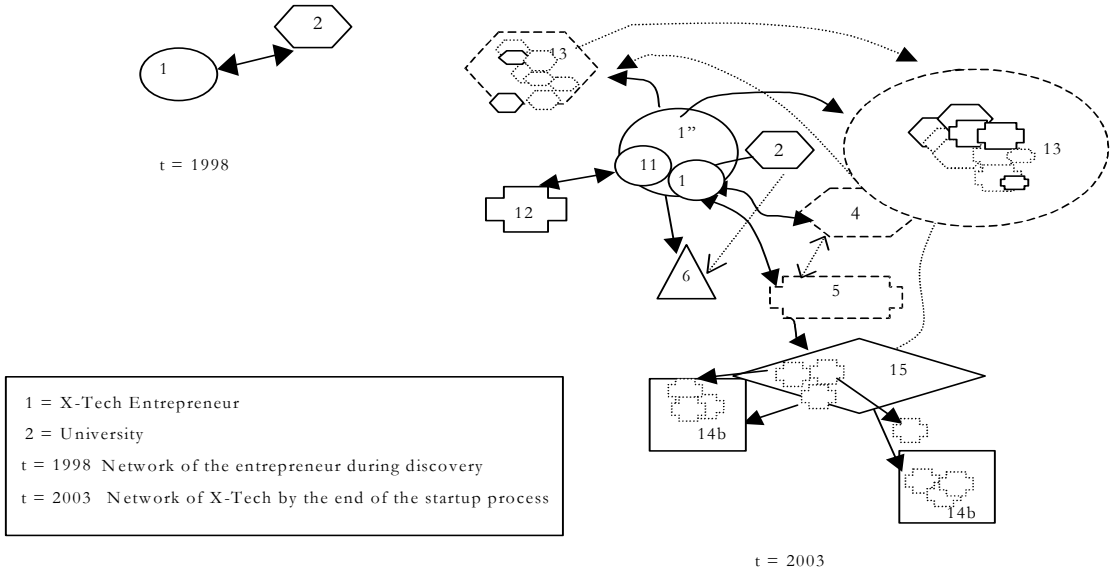

Figure 2: Development of the Network

These activities range from selling products directly, the setting up of a network of distributors to exchange of knowledge with researchers working at universities around the world. Interestingly, the company invites researchers around the world to work with the technology. This will not only increase the awareness of the technology but might also lead to the discovery or development of new applications. Therefore, this approach can be seen as an innovative way of outsourcing R&D.

[3] The company has asked us not to reveal its real name.

The picture above of the network of the company in 1998 and 2003 illustrates the development of X-Tech's network during this period. The network develops from a dyadic network – the company / entrepreneur and the university (research group) – into a complex network of technology providers, other universities and research institutes, clients, agents etc. It is not the intention of this paper to explain the picture in detail; interested parties are referred to Wakkee (2004). The picture is to illustrate some salient developments:

- The original university is still a part of the network, but its role has changed. The starting network work consisted of the entrepreneur and the university, i.e. the strong partner. That the original university is deemed the strong partner is indicative of the role it played in the development of the startup company's network. In 2003, the university still features in X-Tech's network but not as it's only partner and not as it's only university. X-Tech developed cooperation with many universities in the world who test their products in experimental situations. The tie with the university is weaker, but still present.
- The company changed enormously: The original entrepreneur who started the company (in the 1998 picture indicated with "1") is now part of a larger (but still a small) company. In the period from 1998 till 2003 it merged with another company (in the 2003 picture "11", of which the original entrepreneur was also part) and that became eventually a new entity (in the picture 1"). This illustrates that the company is a dynamic entity that adapts to changes and pursues opportunities.
- New organisations enter the network and others leave. Wakkee (2004) describes the development of the network in more detail. Some network relations are of a temporary nature (e.g. with subsidy providers on a specific development project).

About the role of universities

The previous section could suggest that the role of the university is "just" to be the provider of networks and that its role a strong partner is "just" this. In some cases this is true and in others this is not. Going over each of the characteristics of the global startup, we can identify a role for universities. We will use the aforementioned characteristics of global startups to illustrate what role universities can play; we specifically highlight five of the ten characteristics:

- *Global Startups often begin international activities even before the start of the actual operations.*

All companies go through the stages of opportunity recognition, preparation for exploitation and exploitation. Most companies start international activities only in the exploitation stage; global startups already need to begin international activities during the phase of "opportunity recognition". Universities can introduce the potential global startup to its international contacts and relations (universities, companies and capital providers) – if it is willing and able to do so.

- *Global Startups engage in international activities to pursue opportunities.*

Global startups pursue international opportunities and not local or regional opportunities. It is our opinion that the role of universities can support to the founding entrepreneurs of companies that have such a potential. Universities play an important role in achieving this task by indicating and emphasising the global nature of their opportunities.

- *Global Startups are involved in a wide range of formal and informal value-added activities across national borders.*

Global startups often are companies that commercialise products based on a disruptive technology. These technologies are in development and the global startups need to liaise with ancillary organisations e.g. other universities, research labs and companies, in order to get the greatest benefits from the technological developments. Universities are the first and most

important source for global startups in this regard. In addition, Universities can help identify the location of new knowledge and / or facilities at institutes around the world, if they are not able or willing to provide these on the site.

- *Global Startups are typically founded by internationally skilled and confident entrepreneurs, who may or may not have actual international business experience*

Experience shows that many (not all) entrepreneurs who start a company with global potential are graduates of a university. The role of the university could be to promote entrepreneurship and the commercialisation of research. Also, stimulate international entrepreneurship, universities should foster a culture of international exchange and provide skills training programs at all levels of the organisation

- *Global Startups often rely on the relationship with a strong partner; this may be a commercial partner or a research institute*

This statement needs no further elaboration at this moment.

Concluding remarks

Above we have argued that in its quest to build position on the market, a global startup needs to engage in a wide variety of activities, using various network entry modes in order to obtain and develop ideas, engage in R&D activities, create products and sell them on a global market. Lacking both resources, international networks and experience at the beginning of its startup process, a global startup cannot do this alone: having a strong partner is necessary. A university can be such a strong partner, but as outlined above, more than that. A university that fosters entrepreneurship among its students and staff, and opens up its resources (including networks) is more than a strong partner – it is the ideal partner for companies with global potential.

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Trained and experienced entrepreneurs: The critical resource for technology based start-ups?

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INTRODUCTION

The key theme of this paper is that trained and experienced entrepreneurs are a critical resource for successful technology based start-ups. For this paper I have drawn on recent research at the Australian Graduate School of Entrepreneurship (AGSE) into technological innovation and entrepreneurship, which has resulted in the formation of spin-off companies from Australian publicly funded research institutions. Most of this research has been focussed on the class of spin-off companies in which there is a direct ongoing intellectual property link with the parent university or other research agency. Typically, such spin-offs have a strong equity component from the parent institution. Most of these companies will have their first private equity investor within their first five years of existence. In other words, they will be typically private equity capital driven, usually involving a business angel or friend, rather than a formal venture capital fund. In addition, I have drawn on many years of experience gained from working with inventors, discoverers, entrepreneurs and venture finance providers, in the Australian context.

The paper starts with a brief overview of the AGSE and its research and teaching focus, to provide a context for the comments in this paper. We then review the relevant

classes and definitions of technology based start-ups based on research outcomes (and other sources of new technology) to illustrate how this class of companies relates to other types of spin-offs, which may well have different characteristics and differing needs and roles for trained and experienced entrepreneurs. Next we clarify what we mean by competent entrepreneurs and finally, the paper presents an outline of the now well-developed Master of Entrepreneurship program at AGSE. This program is offered as an example of an effective solution to the challenge of producing appropriately trained and experienced entrepreneurs.

CONTEXT – AGSE'S RESEARCH AND TEACHING ROLE

Swinburne University of Technology has been actively engaged in teaching and researching entrepreneurship for some 20 years. In 1986 the university started the first Australian post-graduate program in entrepreneurship, which quickly evolved into the current Master of Entrepreneurship and Innovation (MEI) degree. Some five years ago an Israeli group started to teach the MEI in Tel Aviv. Altogether, over 600 men and women have now graduated with this degree. Today, AGSE has some 300 MEI students, around 400 MBA students and just over 100 doctoral research students.

The research agenda at AGSE covers most aspects of entrepreneurship including opportunity creation and evaluation, venture creation and resource acquisition, and the challenges posed by rapid growth. Of particular current interest are issues to do with the development and evaluation of an entrepreneurial business plan, exit strategy development, the assessment of innovation capability and the annual review of the state of entrepreneurial activity in Australia as part of the Global Entrepreneurship Monitor project. The GEM project also focuses on public sector policy in relation to entrepreneurship. Other and emerging research interests include the fields of indigenous entrepreneurship and social entrepreneurship.

The specific research referred to in this paper on spin-offs forms part of an ongoing interest in the National Innovation System and the related field of extracting social value from publicly funded research.

A TAXONOMY OF TECHNOLOGY BASED START-UPS

Before summarising some of our recent research on technology-based start-ups, it will be useful to clarify the language we use in this field. We have found the following terms helpful.

Commercialisation Process – In the Australian context, commercialisation has a specific as well as a general meaning. In common usage, it means taking an innovation through the process of creating a marketable good or service (i.e. creating a product) and taking that product to the market (i.e. creating a base of customers who will buy the product). In the more specific case of tax-payer funded research in the universities, the CSIRO (Commonwealth Scientific and Industrial Research Organisation) and the CRC's (Collaborative Research Centres), the term has come to refer to a whole host of activities undertaken by these institutions and others, to create social value (or wealth). Thus the "commercialisation process" has become an important part of the national innovation system, whereby publicly funded research is intended to create a return on investment. It is both important and useful to note, though beyond the scope of this paper, that the commercialisation objective has created a serious tension between those who view public sector research as being for the common good, and those who want it to create wealth for investors.

Direct Research Spin-offs (DRSO's) – Sometimes also called spin-outs, these are business ventures in which the parent body (university, etc), retains some equity position in return for its intellectual property contribution. These DRSO's seldom end up in incubators, and often have parent institution research staff seconded to them, either temporarily or

permanently. These types of spin-offs have been the subject of considerable research and policy attention. DRSO's seem to be of two types:

- Product companies – those which actually develop, produce and sell products to commercial markets.
- Technology Asset Companies – those which restrict themselves to only produce intellectual property, which is sold or licensed to other users.

Indirect Research Spin-offs (IRSO'S) – are typically opportunity driven and initiated by students, ex-students and/or staff of the parent organizations. These entities often do go though an incubation phase and have no equity held by the parent institution. They often need up to a year or so to decide whether or not to incorporate – and when unsuccessful often have considerable trouble getting un-incorporated (for legal and other reasons). This type of spin-off, while quite popular, has received little research attention in Australia.

Other opportunity-driven New Technology Small Firms (NTSF) – These are often mentioned in the research literature and are taken to include technology-based start-ups other than those described above.

Technology Transfer Companies (TTC's) - these basically aim to sell consulting services and/or contract research services to industry, government and other buyers. In Australia there are several versions of TTC's operated by universities and other research agencies. Their contribution to parent body income has been very varied.

Holding Companies – these are structured to "hold" or own, various kinds of intellectual property on behalf of their research parent. In some respects, these entities are a response to the preference of external investors to have a simple structure in relation to IP ownership to negotiate with, rather than the usual complexity existing in public institutions.

SOME THEORETICAL CONSIDERATIONS

Given the peculiarities of the Australian innovation system we have also found it useful to differentiate between two kinds of "innovation". Typically, in common usage, innovation refers to anything new (idea, invention, discovery etc.), irrespective of whether or not such an innovation will ever yield anything of value to society. This stands in contrast to the more specific terminology used by earlier writers on entrepreneurship, where the term innovation included the commercial exploitation of the new knowledge. Hindle (2002) has gone to some trouble to sort out this confusion and has proposed the use of 'small-i' innovation to refer to the former kind, and 'big-I' Innovation to the second kind. Using this distinction, Hindle has been able to make a significant contribution to the concept of entrepreneurial capacity and the use of this concept in national policy formulation.

Another theoretical issue that has been receiving attention at AGSE is the question of appropriate research methods for studying entrepreneurship. Campbell (2003) has presented a comprehensive review and analysis of the philosophical underpinnings of entrepreneurship research and further develops the argument that new venture creation is a highly non-linear process and is best understood through the use of holistic rather than reductionist methods. He particularly critiques the limitations of statistical methods, which he argues give only very limited insights into entrepreneurial activity. Campbell also mounts a strong argument that it is not very useful to try to study entrepreneurship without taking into account the central role of the entrepreneur. This theme is also taken up in research discussed below.

TECHNOLOGY BASED START-UPS

One recent example of research in this field is that reported by Yencken and Gillin (2004a, 2004b), who discuss research on 25 spin-off companies from universities and other public research providers. They were interested to see if such spin-offs followed the processes described in the literature for opportunity driven start-ups, and to what extent it was readily

possible to identify the entrepreneur. Sixteen of the 25 cases proved to be analysable in this context, and these were classified into the three groups suggested by Bhide (2000), who classified new ventures into:

1. Opportunity driven ventures, with a clearly identifiable entrepreneur. Examples from the university sector would include those ventures which are spin-offs based on university-developed knowledge, by ex students and/or staff, but which have no IP relationship with the parent university. Nine of the sixteen spin-offs were in this category, and in all cases the founding entrepreneur continued to be the critical driving force even though in several cases someone else had been appointed as the CEO.
2. Venture capital driven enterprises, starting with a technology champion and typically quickly recruiting a surrogate entrepreneur as CEO. These ventures are often Direct Research Spin-offs, and often raise the question of who and where is the entrepreneur. Two of the sixteen companies were in this category and for both of these companies the CEO was recruited from outside.
3. Corporate ventures, well planned and resourced before being set free, with an experienced start-up manager, but not someone who looks like the opportunity driven entrepreneur. In Australia, this model is typical of CRC start-ups. Five of the sixteen companies were in this category. The parents of these spin-offs had well developed capacities to evaluate opportunities and to appoint an experienced start-up manager.

The research identified the important role played by the start-up entrepreneur, whether original founder or surrogate. The authors argue that it is important in the case of spin-offs to pay particular attention to the key question – *who is the entrepreneur?* As the research indicates, the answer is not always self-evident.

The authors stress that an important finding in relation to these spin-off companies is that the trigger leading to the identification and evaluation of the opportunity resided within the

university or other parent body and was closely related to the opportunity finder in the respective organisation. The authors suggest that encouraging research agencies to increase their rate of disclosure will enhance their capacity to create spin-offs.

In another forthcoming paper, this time by Hindle and Yencken (2004), the authors attempt to articulate an integrated model for public research commercialisation. The authors argue that entrepreneurship is the engine of innovation and that "the accumulated tacit knowledge and culture of the entrepreneur are the resources essential to create wealth from research commercialisation, leading to technological innovation and the creation of New Technology Based Firms. This piece, based on prior research at AGSE and on a critical review of the literature, also places the entrepreneur in a position of central importance – both for the opportunity recognition and evaluation task and the complex process of creating a viable new technology based venture.

Some case examples

At this stage, it might be useful to briefly comment on a few actual cases of new technology based ventures associated with Swinburne University, to give some examples of current practice.

The first one arose from an internal business plan competition described further below. The technology relates to a medical diagnostic application and the project is at the stage of working up a funding proposal for external investors. The team consists of both technical innovators and an entrepreneur who is completing a Master of Entrepreneurship course. In this case, the initial equity split is 60% to the University and 40% to the student team, as "sweat equity". If investors are found, these equity positions will of course be reduced.

A second case example is a venture to commercialise some materials technology developed by the University. In this case, an external entrepreneur who knows the potential

market very well has been brought in as an equity partner with the University, which has negotiated an acceptable equity split with the external partner.

In a third case example, a University developed technology will be commercialised with the participation of an external incubator, which will provide the initial business infrastructure to get the venture going and which has recruited an experienced entrepreneur to head up the project. In this case, the University retained 50% of the founding equity, the incubator operator received 25% and the start-up entrepreneur got 25% as sweat equity.

A fourth example arises from research in psychology. In this case, an external entrepreneur has been found to lead the commercialisation process and he was allocated 40% of the founding equity. The researchers were allocated 35% and the University retained 25%. This project is well on the way to commercial success.

These examples are typical of current commercialisation practice in our environment. There are many variations, with some using internal entrepreneurs and others using external ones. In all cases, the selection of the project leader, the entrepreneur, is now considered to be as important as the quality of the technical innovation and the ongoing development of the technology.

KEY COMPETENCIES OF TECHNOLOGY BASED ENTREPRENEURS

Arising from our work on technology based start-ups, including university spin-offs, we can identify a number of key competencies which are needed by entrepreneurs working in this field, whether they are initial champions or brought-in surrogate entrepreneurs. These competencies are:

1. Previous experience in managing a start-up or other NTSF. This may have been acquired by working on a less complex technology start-up, or by being a significant participant in such a venture.

2. Speaking *the same language* as the researchers involved. The language of business and the language of science and technology are not the same. The entrepreneur has to be able to bridge this gap and be able to communicate effectively with both communities.
3. Finding the resources needed and combining them to create synergy. Typically the technology members of the team are not competent to find risk capital and other resources (human, infrastructure and so on) needed to make the venture a success.
4. Ability to live lean and to not give up when the going gets tough. Researchers used to operating in well-resourced and supported environments often find this a major challenge.
5. Intellectual property protection and management. This may include not only patents, but also several other versions of IP, including the deliberate creation of confidential commercial information.
6. Deal making. This is a critical competence for nearly all entrepreneurs and often is quite alien to researchers and inventors.
7. Establishing credibility and networking with national and global players. Complex technological ventures often need the support of a broad spectrum of specialists from government, finance, industry and other sectors.
8. Building strategic alliances. New ventures often succeed with the help of powerful friends – who may at some time in the future also be the means to a successful exit strategy.

These insights into the competencies required of start-up entrepreneurs are of great use in designing and delivering appropriate training programs to enhance entrepreneurial skills and knowledge. Our approach to this task is discussed next.

TRAINING AND DEVELOPING ENTREPRENEURS & OTHERS

At AGSE we have accumulated experience in several types of entrepreneurship education and training. These include familiarisation courses for non-entrepreneurs and comprehensive and professional programs for practicing entrepreneurs and their advisors.

Familiarisation courses

At the most basic level, we run courses for research and technology students and staff to familiarise them with the issues involved in commercialising new inventions, discoveries or other forms of intellectual capital. These types of courses run from one day to five days in duration and provide an overview of what is involved in assessing whether or not a technological innovation may have commercial applications, through the protection of IP, to what is involved in either selling or licensing the IP or taking it into a new special purpose venture. We have delivered such courses to staff and students within Swinburne University and also to similar audiences in other universities. The typical outcomes of such learning experiences are a better understanding of the challenges and complexities involved in the commercialisation process, and a greater sense of realism about the need for entrepreneurial capacity in that process.

We also run familiarisation courses for non-academic staff of the university as part of a larger culture-change program aimed at helping the university to become more entrepreneurial in the broadest sense. These courses have also proven to be highly popular among staff and have resulted in a number of significant innovation initiatives being pursued in the university.

The Swinburne Venture Cup

Several years ago, the university introduced an annual business plan competition for students from the three levels of the university, namely technical college students, undergraduate students and postgraduate students. The prizes are significant and the competition has produced some really interesting new ventures. As part of the competition, participants are offered workshops in the fundamentals of assessing an opportunity and in the art of developing a viable business model and translating that into a winning business plan. The entries in the competition are judged by a panel of external experts, including business angels and venture capital providers. This initiative is run jointly between the AGSE and the university's technology commercialisation unit. The Venture Cup generates a considerable level of excitement each year as teams are formed and venture ideas are shaped and developed into meaningful competition entries. The participating teams are typically comprised of students from several disciplines, bringing together the technical innovators and the more commercial entrepreneurial types.

Professional programs

The highest level program run by AGSE is a full course-work master's level degree – the Master of Entrepreneurship and Innovation, or MEI. As noted earlier, this has evolved over some 20 years and is now operating at a highly developed stage. As this has been a pioneering program, I will outline it in sufficient detail to give you a taste of what it is about.

The MEI was started with the aim of doing something about enhancing entrepreneurial capacity. It was well recognised in the eighties that Australia was quite good at generating new technological innovations (inventions, discoveries and so on), but lacked the ability to gain maximum commercial benefit from such innovation. A combination of academic and industry talent came together to craft a special purpose program that might address this need. It was recognised at the outset, that those who take a leadership role in the commercialisation

of innovation, tended to be different from those who were brilliant at coming up with new inventions and discoveries. At that time also (20 years ago), Australia was experimenting with its first serious effort to create a venture capital industry, and the stock market was enjoying a boom in "high tech" new ventures. In '97 the stock market crashed and a few years later the Australian economy went into a severe recession, which did not turn around till the mid 1990's. In spite of these vicissitudes, the MEI program survived and continued to evolve.

Today, the MEI is considered to be, to professional entrepreneurs, what the MBA is to professional corporate executives. A growing number of entrepreneurs and their organizations (such as the Young Entrepreneurs Organisation, or YEO) are recognising the need for the development of a profession of ethical, serial entrepreneurs. The underpinning driving forces seem to be very similar to those which led to the creation of professional programs in management, accounting, marketing and other business related professions. The key forces are the rapidly growing body of knowledge needed to underpin a profession, the research base to keep that body of knowledge alive and growing, the increasing complexity and specialisation of knowledge needed to start a new venture in a global context and the growing public recognition of the need for ethical and competent behaviour among entrepreneurs. How then is the MEI structured and taught? More comprehensive details are available from the AGSE website via the university's portal at www.swin.edu.au. Here I will present a brief overview. It is important to recognise, however, that we do not attempt to make entrepreneurs out of people who have no entrepreneurial talent. We assume that those taking the MEI program have sufficient entrepreneurial talent and motivation to undertake such a task, in much the same way that architecture schools assume that their students have the requisite latent talent and drive.

With the above in mind, an outline of the program goes as follows. The underpinning assumptions are that entrepreneurs go about their work of creating and developing new enterprises (whether business or social) in three broad stages. The MEI similarly has three

stages, each one mirroring the entrepreneur's tasks. Each stage consists of four subjects, or courses. Thus the full MEI requires the student to successfully complete 12 subjects.

The first stage recognises that entrepreneurs start by creating or discovering what looks like an opportunity. As is well known, not all things that look like opportunities are indeed viable, and many an entrepreneur has wasted much time and other people's money in the pursuit of false opportunities. By contrast, experienced and knowledgeable entrepreneurs are able to assess opportunities and walk away from those which are not going to work. So the core subject in Stage 1 is "Opportunity Evaluation", in which students learn a disciplined method for identifying and evaluating opportunities. As an aside, this subject is also proving to be of considerable interest to a much wider audience than that of professional entrepreneurs. The other three subjects in Stage 1 provide additional foundation knowledge and skills in the areas of "guerrilla marketing" (creating markets with very limited resources), the fundamentals of venture finance and the foundations of organization creation (knowing self and others and how to create an effective organisation).

Once an entrepreneur has a viable opportunity, the next task is that of procuring resources, creating an organization and creating a customer base. Stage 2 of the MEI focuses on these and related issues. The core subject for this stage deals with understanding business models, business strategy and learning how to craft an effective entrepreneurial business plan. Our own research and that of others has shown that entrepreneurial business plans are not the same as those for existing business units in established corporations. In essence, the entrepreneur has to craft a business plan to sell something that does not yet exist and which may not have anything else to compare it with. This reality creates special challenges for the entrepreneur not faced by an executive putting up a case for growth finance to further develop an already operating business. The other three subjects in Stage 2 again supplement and add to the core theme. We have another organisation subject dealing with the special people-

related challenges of an often rapidly growing organisation. For many start-up ventures this is the biggest hurdle to be overcome. Often, the start-up team is inappropriate to manage the larger enterprise and critical human resource decisions need to be made. Another subject deals with more advanced issues in finance and financial management, and with legal and regulatory issues faced by the entrepreneur. The fourth subject in this stage focuses on the art of maintaining a high level of creativity and innovation in a new venture, something which often suffers badly as the organisation becomes more complex.

In Stage 3, we deal with those matters that face an entrepreneur after a successful start-up and when the enterprise may become too complex or too routine for the entrepreneur to remain competent or motivated. In this stage we deal specifically with the challenges of developing an effective exit strategy, or transition strategy to a professionally managed enterprise. The core subject in this stage deals with how growing ventures are evaluated from the outside, and with the options open to an entrepreneur to exit or transition. These include the strategies of an Initial Public Offering (IPO), or trade sale, or other means of increasing equity to required levels. Other subjects in this third stage include a third level of organisation study, dealing with high level leadership and governance issues, a subject dealing with negotiating skills and a subject dealing with the art of corporate entrepreneurship and innovation, which we view as a critical component of maintaining competitive viability as the enterprise matures.

These three stages and twelve subjects make sense to students as soon as they are able to see the overall design of the program. The individual subjects have undergone considerable modification over the years, but the three-stage model has remained as the key design principle behind the program.

Recently, we have added an optional fourth stage to the program, allowing students to choose to do an “honours” version of the MEI. In this fourth stage, students could choose to further elaborate their program of studies by either taking additional electives, or by doing a

four-subject-equivalent minor research thesis. We have found that a significant minority of students want to do research in the entrepreneurship field and this recent addition to the program provides such an opportunity.

CONCLUSION

Research at AGSE has added to the existing knowledge about the factors that are important in ensuring the success of technology-based start-ups. Both our research and that of others and our direct experience in working with inventors and discovers has provided further support to the view that highly competent technical innovators are seldom able to act as the start-up entrepreneurs for technology based ventures. We have also found that such innovators may be quite receptive to learning about the complexities of the enterprise creation process, but are not themselves suitable to be trained to be effective entrepreneurs. The talent, skill, knowledge-set and values of successful inventors and discoverers tend to be quite different from those of successful entrepreneurs. There seems to be little point in trying to make good researchers into mediocre entrepreneurs.

By contrast, the entrepreneurship education and training programs developed and delivered by the AGSE have demonstrated both the need for and the effectiveness of professional level education for appropriately talented latent and/or emerging entrepreneurs. An effective national innovation system will recognise and support all three critical factors of the wealth creation process – technological innovation, venture finance and the development of a strong cohort of trained and experienced entrepreneurs.

ACKNOWLEDGEMENT

I want to acknowledge the advice and help received from my colleagues at AGSE and in particular, that of John Yencken and Bruce Whan. Their help is much appreciated.

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VALOR – Knowledge valorisation through spin-off generation[1]

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ABSTRACT

Generating knowledge through research is the start of a process that should lead to innovative products and processes. But in Europe many primary research results remain unexploited. VALOR is designed as the precursor of a full ERA-NET on the generation of spin-off companies – one of the most widely-used means through which research results are applied. Many national programmes to encourage spin-offs focus on specific aspects rather than tackling the entire sequence, from research to production. VALOR will benchmark programmes and identify good practices, as the basis for the subsequent ERA-NET to develop joint programmes for the optimum guidance and support of spin-off companies.

[1] The following text is taken from an EU publication on ERA-NET and the VALOR programme. For further information please visit www.eubuero.de/arbeitsbereiche/eranet or www.cordis.lu/coordination/home.html.

VALOR is a nine-month project aiming to lay the foundations for a full ERANET dealing with practical support for the development of spin-offs. The partners aim to get to the heart of the 'European paradox' – the yawning gap between Europe's world-class academic research and its much less successful industrial innovation. Despite massive spending on research in all areas, much of the knowledge generated fails to result in commercially viable products and services. More needs to be done to bridge this gap before the EU's Member States can become competitive, knowledge based economies.

VALOR will not address all of the many ways in which basic research results are commercialised. It focuses on knowledge transfer and spin-offs – new, research-driven companies established to commercialise knowledge which was developed by, or through a close working relationship with, a university or research institute. Spin-offs from research establishments directly translate new knowledge into marketable products or services. As a result, they can make a substantial contribution to increasing employment and economic growth, while fostering and strengthening links between industry and science for the future. Spin-offs are naturally aware of the importance of knowledge application, and are open to the growing understanding of the factors which favour the foundation of successful enterprises.

Knowledge exploitation

The process of turning an interesting research result into a marketable product through a spin-off company involves three definable stages. The first identifies the market potential of research results, the scientists with the entrepreneurial understanding to appreciate this potential, and other conditions for successful development such as the availability of seed capital and the regional climate for investment. The second stage is the incubation of the potential spin-off – concrete plans are made, with proof of the technical principle, development of a business plan and strategies for marketing, intellectual property protection and early stage finance. The third stage introduces the product to the market, and involves

research into competition, finding customers and expanding investment to finance the pre-profit growth phase. Market introduction is crucial, and increasingly requires a European approach, since neither spin-offs nor venture capitalists are any longer interested in purely national markets.

Enterprise culture

VALOR is examining the importance of stimulating, through each of these stages, a culture of entrepreneurship in universities and research centres, and will define the critical factors for the improvement and success of future spin-offs. The project aims to enhance the effectiveness of the whole exploitation process, recognising that many national spin-off programmes are geared to just one or two aspects. In some Member States support initiatives are so numerous that they overlap, and spin-offs are often confused about where to find financial and other support.

Learning from others

Most national and regional programmes started independently and have only recently exchanged experiences, although some studies have shown the benefits of co-operation. VALOR sets out to stimulate exchange of knowledge and experience on spin-off creation, defining good practices and objectives for the quality and scope of spin-off and incubator programmes. This will be achieved through workshops on each stage of the process, consultation with governments, research institutes, universities, research-based firms, banks and investors. It will look at the problems facing spin-offs and identify indicators that can enable managers to assess and compare their programmes with others. Success can be measured not only by the number of spin-offs created or the number of patents held, but in terms of economic performance and growth after several years. Good practices will then be selected to enable programme managers to make improvements. Although VALOR involves

only five partners, they aim to identify more from other EU Member States, Acceding countries and Associated states, which can contribute to the subsequent ERA-NET.

Not confined to a single research topic, VALOR and the ERA-NET which succeeds it will be open to all involved in spin-off generation as a means of knowledge exploitation. The ERA-NET will take the study of the spin-off process further by developing new joint activities – perhaps through the convergence of existing programmes, or by developing new joint incubator programmes among partner organisations. The tools and methods it develops will also be invaluable to other ERA-NETs, as well as to national and international research programmes.

International Projects to Promote University Start-ups: The Embryo and GlobalStart Experiences

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ABSTRACT

The University Miguel Hernandez (Elche, Spain) is carrying out a specific programme to encourage and support entrepreneurship in the academic environment. This programme is based on two european projects, "Embryo" and "Global Start", both developed with the financial support of the 5th Framework Programme of the European Commission, through the EC Programme "Promotion of Innovation and Encouragement of SME Participation".

This university programme starts on the basis that there is a great potential of business and job creation through the improvement of tools and mechanisms to transfer university's technological and innovative potential to the social and economic agents that are able to make use of it, creating new firms and promoting qualified employment.

The main objective of the programme is to help university entrepreneurs to start-up their businesses, taking into account four basic elements:

- Research groups, who bring their research results and can take part in the entrepreneurial activities.

- Entrepreneurs working on business projects.
- The University, which provides the needed infrastructure for the programme.
- The network, made up by entrepreneurship support entities of the region, investors, etc, to support the university programme.

The programme is being a useful instrument in our university to promote and transfer information between technology developers and potential users, fulfilling the gaps in business management skills and knowledge showed by technology oriented researchers.

1. UMH OVERVIEW

The University Miguel Hernández (UMH) was established in 1997 offering 18 degrees to 4.000 students with the aim of focusing not only on education, but also on research and other services. Nowadays, the UMH has 31 degree courses offered to more than 10.000 students in the fields of Experimental and Technical Science, Health Science, Social Science and, Arts. The objectives of the UMH for the next years are to achieve 15.000-20.000 students as well as the implementation of 14 new degree courses.

At the research level, the university has roughly 250 researchers, grouped into 60 lines of research and into relevant Institutes and Centers such as the Neuroscience Institute, the Center of Molecular and Cellular Biology, the Bioengineering Institute, the Operations Research Center and the Center for Drug Research.

Although main administration offices are located in Elche, the UMH is organised in four campuses located at different places of the province of Alicante (East coast of Spain).

See figure 1

The economy of the region is one of the most dynamic economies in Spain and it favours the enterprise setting-up. This entrepreneurial culture facilitates the development of the UMH as an entrepreneurial university, creating strong links between the university and the economic fabric of the region, as also working out in other European universities (Anderson, 1999; Testar et al. 2002; Gómez et al. 2002a; Marcos, 2002; Conesa et al. 2002).

Taking into account this specific setup, the entrepreneurship in the university is framed in a mixed structure made up by an academic research group and a specific office to support entrepreneurs, also effective in other universities (Solé et al, 2002). The academic group is in charge of studies and the development of new methodology for promoting the entrepreneurship, and the office for entrepreneurs is in charge of implementing the day by day of the university programme focused on entrepreneurs.

2. ORIGIN OF THE PROGRAMME FOR ENTREPRENEURS: KEY INTERNATIONAL PROJECTS

International projects are taking an important role at the UMH, since have allowed the development of relationships with foreign organisations to exchange experiences and apply new knowledge to improve entrepreneurship at the university. In this sense, two international projects, “Embryo” and “GlobalStart”, are playing a key role. These projects have the financial support of the 5th Framework Programme of the European Commission, through the EC Programme “Promotion of Innovation and Encouragement of SME Participation”.

2.1 Embryo Project

The university carried out from 2000 to 2002, the project titled “Development of Embryo firms for the transfer of technology from universities” (Embryo Project). Also in this project

participated the University of Twente (The Netherlands), who is recognized as one of the entrepreneurial universities in Europe.

Focused on the creation of university spin-offs, the target of Embryo Project in the University Miguel Hernández was the idea to link the objectives of two university services. One addressing to researchers (The Technology Transfer Office) and the other to students and graduates (Observatory of Employment), matching them into the Embryo Firm concept (Figure 2): "a framework where a research group of the university and a student with entrepreneurial profile are matched in order to set up a spin-off using technology and/or knowledge developed by the university" (Gómez et al, 2002b)

See figure 2

The project was focused on the following target groups:

- Final year students, specially those with an entrepreneurial profile and related from the technical departments, such as Industrial Engineering, Telecommunication, Biochemistry, Environment Sciences, Statistics, etc.
- Graduates and PhD candidates with an incipient research experience and knowledge of technologies, but with a need for support, consultancy and facilities, to allow them to look for business opportunities for spin-off company creation.
- Lectures and other researchers from the different institutes and research centres, who might have technological opportunities with great potential for generating a spin-off company.

The process to facilitate the setting up of new companies in Embryo consisted in providing support to the above target groups (Figure 3), and the infrastructure, developed with Embryo project, has been one of the benefits for the current support programme for entrepreneurs at our university.

See figure 3

Also Embryo had a starting up effect of the entrepreneurship at our university, since during the project more than 450 people have enrolled in entrepreneurial courses, of which roughly 75 people were involved in business projects and currently, the methodology is applied at the UMH to help entrepreneurs in the early stages of development of business projects.

In addition, the work scheme developed with Embryo, facilitates the interaction between the involved social agents in the development of a network of entrepreneurship in the region.

2.2 GlobalStart Project

This project, where the UMH is currently involved, is titled "New concepts to stimulate the creation of global university start-ups across an european spin-off programme", and attempts to support academic spin-offs addressed to a global market (GlobalStart DPR, 2002).

GlobalStart project is based on the idea of global start-ups are a rather new phenomenon in the field of start-ups, since most starting companies focus, at first, on the market immediately surrounding them (the local, regional, and sometimes the national market, depending on the size of the country). This type of new venture is defined on the context of the project as "a firm that from its inception seeks to derive a significant competitive advantage from the combination of resources and the sale of outputs in multiple countries".

GlobalStart is running since July 2003 participating eight organisations of European Union countries including two new joined countries. It is co-ordinated by the University of Twente (The Netherlands), and, in addition of UMH, the partners are: University of Salamanca (Spain), University of Leuven (Belgium), University of Warwick (England, United Kingdom), Finance Wales (Wales, United Kingdom), University of Brno (Czech Republic) and University of Tartu (Estonia).

The main objectives of the project are:

- Create a collaborative network of spin-off programmes, in order to support spin-off programmes focused on global start-ups and develop tools to:
    - Implement a quality system solution oriented to university spin-off programmes.
    - Develop a marketing and promotion guide for university spin-off programmes.
    - Develop a system of indicators to track technological entrepreneurship in academic organisations.

- Development of procedures to facilitate the support to start-ups in a global environment, (e-platform, operational database, etc.).

This project will help our university to improve the management of the current programme for entrepreneurs.

3. SHAPING THE ENTREPRENEURSHIP SUPPORT AT THE UNIVERSITY

The university has shaped the current entrepreneurship support system making use of results derived from above international projects (Galiana and Mira, 2002). These results allowed our university:

- to implement a useful methodology for the promotion and creation of new ventures,
- to improve the organisation and use of the university resources,
- to develop a network involving entrepreneurship support entities, financial entities and,
- to improve the support offered to entrepreneurs as better economical and non-economical facilities (infrastructures, advisement, etc.).

In this way, the current entrepreneurship in the UMH is outlined in the following picture:

See figure 4.

This figure shows the key basic elements concerning the entrepreneurship support in our university. With the two international projects described as mainstays, the different pyramid levels show target groups of the programme for entrepreneurs: undergraduates graduates, lecturers, researchers and PhD candidates from the different institutes and research centres of the UMH, who might have technological opportunities with great potential for generating a spin-off company; nascent entrepreneurs with a business idea; and new firms and spin-offs finally created by nascent entrepreneurs.

Around the pyramid we find the main elements implied in supporting target groups: the Technology Transfer Office (OTRI) which is in charge of keeping in touch with the

researchers; the Observatory of Employment, which is in charge of keeping in touch with graduates and undergraduates as well as to support nascent entrepreneurs; the UMH entrepreneurship network, made up by entities which UMH holds relationships to encourage and support the entrepreneurship; and the Scientific Park project which will provide new university firms with improved infrastructures.

3.1 Support offered by the programme for entrepreneurs

The mission of the OTRI is to promote and foster the research activity of the UMH as well as to contribute to the diffusion and transfer of the generated knowledge to the society. In this way, the OTRI has a double task: acts as a service in charge of the technical and administrative management of the research activities developed in the university, and is a link between the university and its socio-economical environment, promoting the relationships and collaborations among the research groups, institutions and companies through R+D actions and technological support.

In the entrepreneurship context, following the Embryo methodology, the OTRI is in charge of keeping in touch with researchers, to identify, evaluate and protect the capabilities and knowledge generated with potential to be transferred to the economical sector through business creation.

On the other hand, the Observatory Of Employment is a unit created in 1997 which holds relationships with graduates and undergraduates, with the objective of increasing their employability, through improving their labour experience (internship programme), access to employment (managing job offers and developing workshops to facilitate employment search) and self-employment (through the programme for entrepreneurs).

The Observatory of Employment is in charge of organising the human and financial resources, and planning and carrying out the activities of the programme for entrepreneurs: developing the promotion plan, tracking of outcomes, establishing and managing of relationships with entities of the entrepreneurship network, etc.

The programme has developed a route for nascent entrepreneurs with a business idea and interested in start up a business. Just like the attendance to conferences, the entrepreneurs who access at the route to develop the business plan can be rewarded with academic credits. The entrepreneur's route is outlined in the following picture:

See figure 5.

Nowadays, about 15% of students are enrolled in some of the activities of the programme, and the communication with them is carried out through a system based on mobile's messages combined with the website to provide complete information about programme for entrepreneurs activities.

3.1.1 Motivation and awareness creation:

The activities included in the annual plan of promotion of the programme for entrepreneurs are mainly entrepreneurship motivation conferences and workshops, as well as the regular services to entrepreneurs. These activities are supported with diffusion materials (brochures, posters, handbooks for business creation, etc.) and a website of restricted access for university entrepreneurs. In this website, the students can find general information about the support activities of the programme for entrepreneurs, enrol the events organised as well as useful information related to the start-up of a business (funds, business plans models, cases of successful university start-ups, etc.).

These activities are developed in the four campuses in a regular basis with the participation of businessmen and entrepreneurship support entities of the region. The main activities are:

- Informal meetings among potential entrepreneurs to discuss about general subjects of the business start up process.
- Conferences focused on subjects related to start-up companies.
- Workshops to present successful experiences in creation of start-ups, in order to show good practice and references to potential entrepreneurs.
- Organisation of the business ideas awards "Innova-Emprende" (Innova-Start-up) addressed to university students.

3.1.2 Advisement and mentoring:

The programme provides support to entrepreneurs and their technological projects as: development of business plan, training in technological and business management, facilities and access to infrastructures (lab space and equipment, offices, etc.), advise on firm's internationalisation, advise on IPR, access to entrepreneurial networks and to financial resources (risk capital, business angels, financial entities, etc).

This advise is provided by both the programme entrepreneurs' experts and external advisors of private consulting companies involved as stakeholders of the entrepreneurship network of the university, offering the possibility of receiving specific advise of important consulting firms in different areas: legal, economical, technical, industrial property protection, quality management, etc.

3.1.3 Training and resources to start-up a business:

The students involved in the itinerary are trained with courses and workshops related to business creation, business management, marketing and entrepreneurial skills. This training is organised and developed with the collaboration of stakeholders of the entrepreneurship network. To drawn up the business plan, the students are provided with the necessary infrastructure and facilities, located at the office of the Observatory of Employment.

The students with a viable business plan are oriented on bureaucratic procedures to start-up the business and to apply for public funds. Also, the programme for entrepreneurs acts as a link between the new business and the incubator of the business innovation center (BIC) of Elche and the set up businesses receive advise by the programme for entrepreneurs. It tracks these new ventures in order to know their necessities and support them.

3.1.4 Research activities on university entrepreneurship:

On a regular basis, the research group focused on entrepreneurship carries out studies related with the entrepreneurship at the UMH, as well as studies related to business creation in the local environment. In this sense, besides the participation in Embryo and GlobalStart projects, they are taking part in a project called “Alicante Emprende”, belonging to the european initiative EQUAL, with the objective of encouraging and supporting entrepreneurship in the local environment (Gómez et al 2003)

Also a new initiative of this researches is the participation in the Global Entrepreneurship Monitor 2004 (GEM Project) at regional level, in order to know and quantify the entrepreneurship in the region comparatively with other participant regions, and to extract lessons to improve the regional support for entrepreneurs.

3.2 Entrepreneurship Network

As we have seen in previous sections, the entrepreneurship network has a relevant role in the programme for entrepreneurs (Uninova, 2004), providing it with complementary resources and services to support nascent entrepreneurs and new firms: training, incubator, access to financial resources, etc. Also, the collaboration of the university with stakeholders has produced a great number of contacts for future initiatives for improving the entrepreneurship support.

See figure 6.

The network is made up by entities related to promotion and support of the entrepreneurship and technology transfer, such as development agencies, business innovation centers, technological centers, universities as well as private consulting firms, financial entities and potential business angels:

- IMPIVA (Instituto de la Mediana y Pequeña Empresa Valenciana), the regional development agency of the regional government, which develops the promotion of industrial policies focused on small and medium enterprises support programmes to innovation. IMPIVA offers several services, and has a network of technical facilities to support innovation. Among its programmes, a plan for micro-SMEs and for the creation of enterprises can be highlighted.

- Technological centers. Private and non-profit-making associations of enterprises, focused on promote technological innovation, research and development in regional industry, and to increase competitiveness and product quality of companies. The Valencia Community has 24 centres, 15 headquarters and 9 technical units.

- The Business Innovation Centers (BICs) of the region act as incubators of entrepreneurial initiatives, promoting innovation and diversification. They give technical support that allows to reduce the entrepreneurial risk and to increase the possibilities of success of these initiatives in the most difficult steps of the setting up.

- Local Development Agencies (LDAs) are autonomous organisms of the city councils. They give support to local entrepreneurs and promote the specialisation and innovation in the local industry. Many of the biggest towns in the region have their own Local Development Agency. The UMH keep special relationships with the LDAs of Elche and Alicante.

- IVAJ (Instituto Valenciano de la Juventud): a public entity, which has a business creation programme, including grants, for entrepreneurs under 30 years old.

- Local business associations like JOVEMPA (Association of young entrepreneurs of the province of Alicante) or COEPA (Confederation of Entrepreneurs of the province of Alicante).

- Chamber of Commerce of Alicante: It provides a whole support system to the entrepreneur through its programme “Prop Emprendedores”, from new business creation’s facilities to secure future viability.

- Private consulting firms offering customised advisement to nascent entrepreneurs in different areas: legal, economical, technical, industrial property protection, quality management, etc.

- The international stakeholders of the network are mainly universities and organisations involved in the international projects where UMH is taking part. These organisations have an experimented university spin-off programmes (TOP-University of Twente, WSP-Wales Spin-out Programme, the EFS-University of Warwick and the programme of the Catholic University of Leuven) from north to south European regions with high-economic and enterprise potential in a global market.

4. FUTURE PROSPECTS

The future challenges of the programme are focused on improving the entrepreneurship levels and meeting new requirements of the business creation environment in academic organisations.

The commitment of the university with the entrepreneurship is showed in its Strategic Plan (2003-2007). In this plan, the UMH has drawn up actions to achieve objectives as the creation of a scientific park. This project is starting and giving its first steps like the contacts with the industrial sector and social entities of the regional environment. The scientific park will be focused on the research and technology transfer for the main industrial sector of the close region (footwear, logistic, food and metal) as well as to provide office and lab space to new technology based firms of the university.

Furthermore, first contacts with potential business angels are being developed and the participation in new international projects are being evaluated as key point for continuous learning, shaping and improving on entrepreneurship knowledge at UMH.

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FIGURES

Figure 1. UMH location

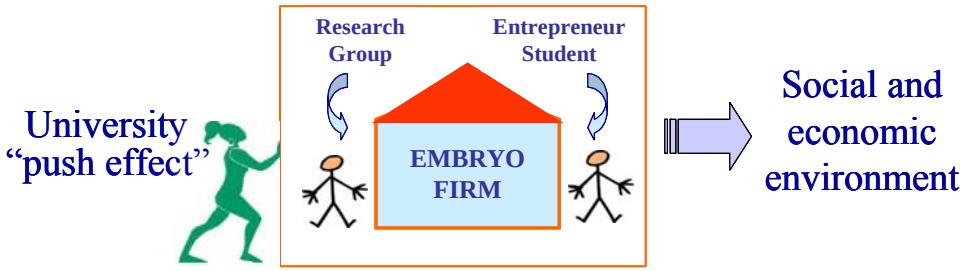

Figure 2.- The Embryo Firm concept (Gómez et al 2002b).

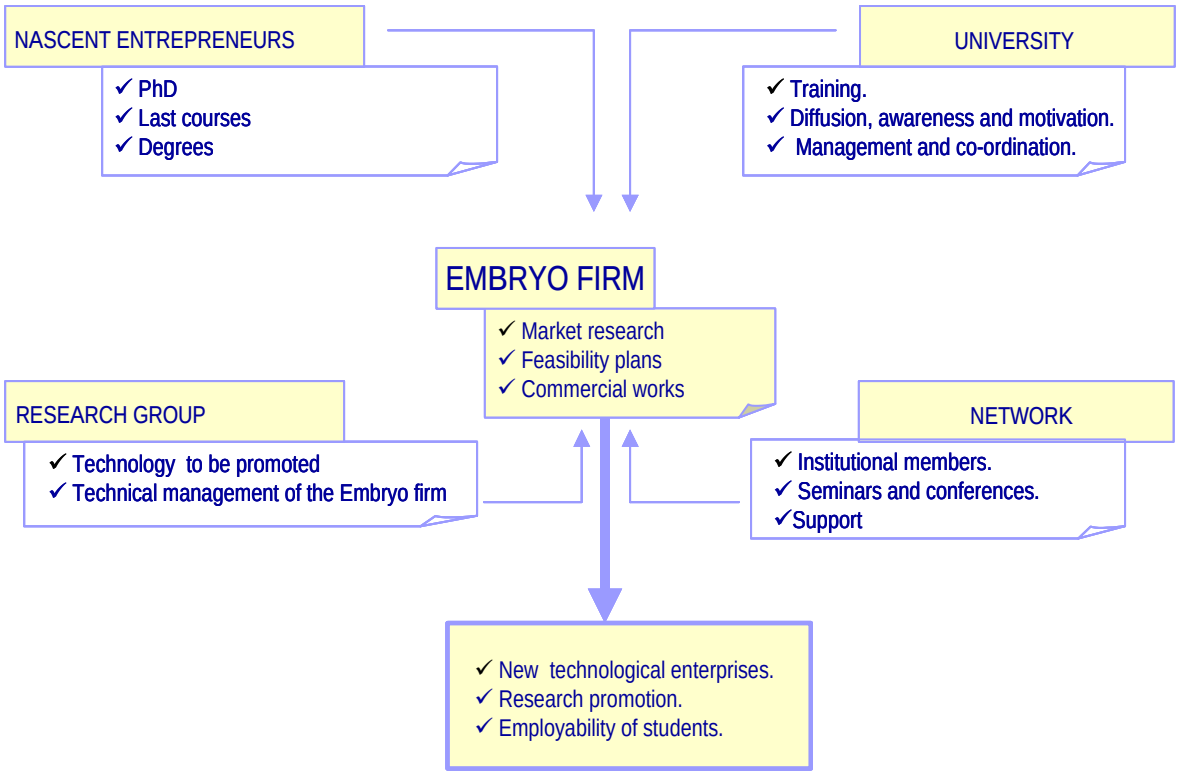

Figure 3. Process to develop the Embryo firms at UMH (Gómez et al 2002b).

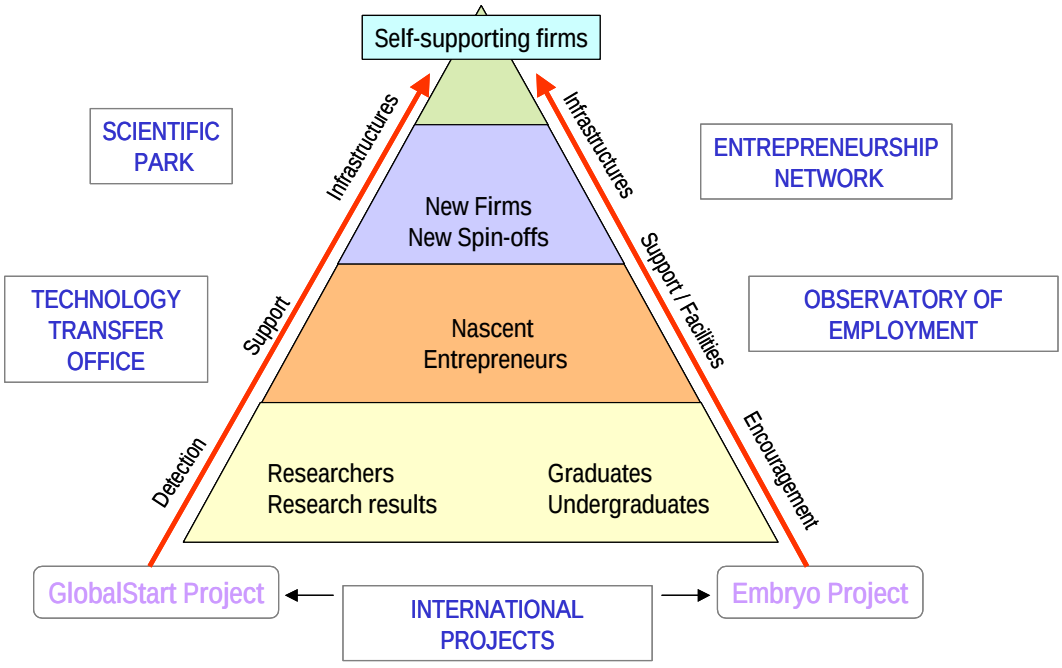

Figure 4. Outline of the entrepreneurship at UMH.

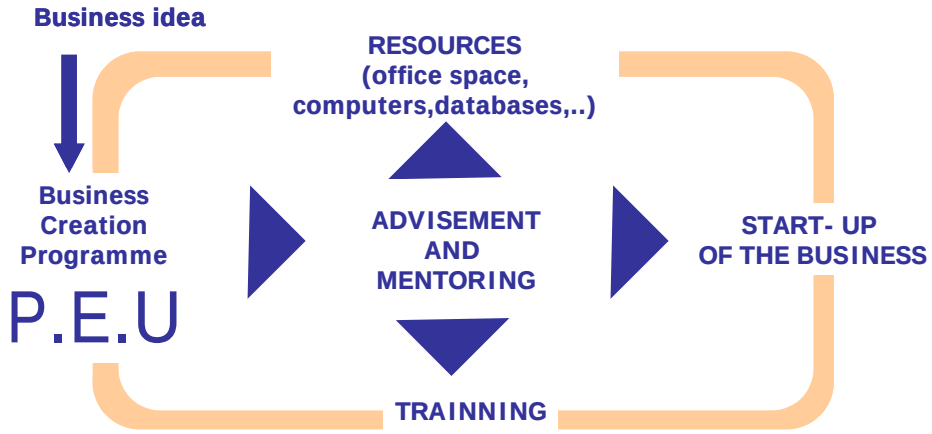

Figure 5. The programme for entrepreneur's route (Gómez et al 2002b).

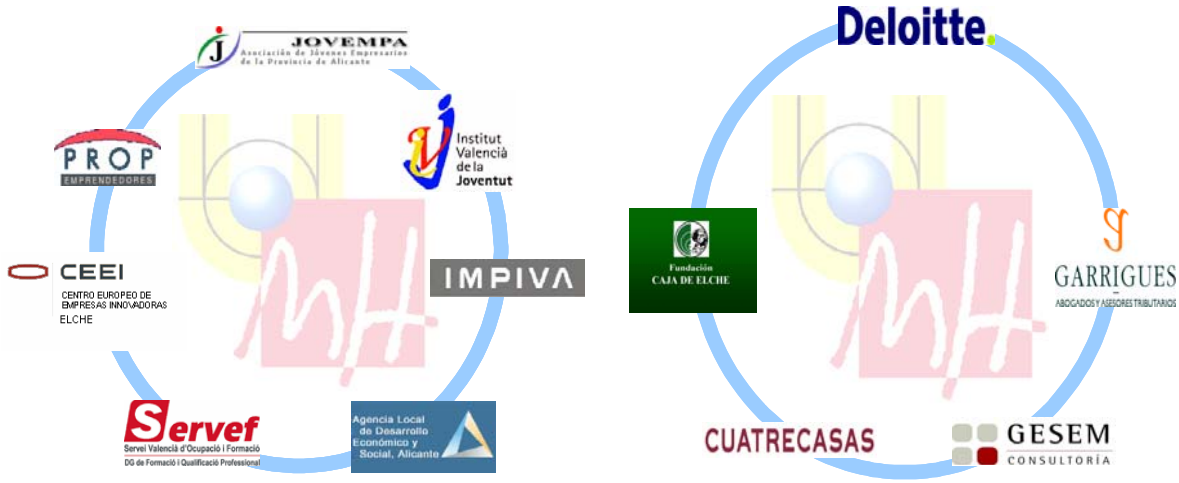

Figure 6. The entrepreneurship network at the university.

The project "Safety and health in entrepreneurship education" as an example for international cooperation of universities

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Summary

The goal of the project "Implementation of Safety and Health in Entrepreneurship-Education"[4] was to raise the awareness for safety and health at the workplace, especially during the education of potential entrepreneurs as well as students. The other goal was also to implement the developed lectures in the curricula of the partner universities and on other institutions.

It aims to support the improvement of safety standards in smaller and middle-sized companies. In actuality, safety and health are often not taken seriously enough even though these are important economic and competition factors.

The project was coordinated by the German company IBH (Innovation und Bildung Hohenheim GmbH), a 100 % - subsidiary of the University of Hohenheim and the Spanish project partner SIPCRE the Spanish project partner SIPCRE, a subsidiary of the University of Valencia. Both of them are also working together in other international entrepreneurship networks, for example "TRANSACT" and "Gate2Growth".

[4] The project was financed by the EU organization OSHA (European Agency for Safety and Health at Work).

The idea of IBH and SIPCRE was to create two different parts of a safety and health training module. Then to translate these two parts in the other language and disseminate it.

1. Description of the activities

By conferring with experts and entrepreneurs from the laboratory and office areas, the current status has been determined. At the end a conception for the application has been formulated. The following activities have been carried out:

Formulation and execution of two training modules

Goal: Raise the level of consciousness for safety and health in the laboratory and office workplace and implement it in (university) lectures.

Target group

- People that have not yet founded companies (pre-founders)
- Founders of small-sized companies
- Students of entrepreneurship education
- Participants of entrepreneurship seminars
- People in Germany and Spain

Training module

Two different training modules including instructions have been formulated and these have been implemented in the form of seminars that took place in the respective countries.

IBH formulated a two-hour-long module for the laboratory.

With the topic: “Work in the laboratory and stay healthy and safe” two seminar units were carried out at the University of Hohenheim and the University of Tübingen. The invitations

and folders containing information about university and entrepreneur institutions were mailed to universities whereby a special emphasis was placed on the area of biotechnology.

In the seminar, entrepreneurs expose to practical experience. Professional advisors reported about what the path to a healthy and safe laboratory looks like and how it can be travelled while avoiding the stumbling blocks. They also gave information about those who give support to starting entrepreneurs along the way and what services they offer.

In addition the new Internet portal www.sh-ee.org was introduced.

A folder with the following contents was given out:

- Government safety organisation folder
- Handout from the Website
- Names of the project contact persons
- Attendance list
- Questionnaire
- Company founder information from the government safety organisation

SIPCRE formulated two-hour awareness-raising modules for the office in Spanish and English languages including presentation material, two video films, student's manual, teacher's manual.

Development of the module started in February 2003, and the prototype for this first edition was ready by the end of April 2003. Along this development period, they could identify 3 stages:

- The workshop's objective is to make company founders and entrepreneurs aware of the relevance of implementing a labour risks prevention scheme in the office environment of their enterprises

- including in their business plans as well the actions required to protect workers and company founders
- to identify the resources needed to carry out that protection in a preventive way.

SIPCRE, S.L. has participated with them in collaboration with Programme IDEAS from the Polytechnic University of Valencia. SIPCRE has developed, imparted and organized the training activities and has made it available to Programme IDEAS’ company founders and MBA students at the Polytechnic University of Valencia, so that they may benefit from the activities.

2. Products

2.1 Training modules

Slogan: Laboratories are healthy and safe!

Laboratories are especially sensitive work areas. The potential dangers are significantly higher here than in a “normal” workplace. This means avoiding the following special dangers: biological, chemical and machine-related.

IBH sharpens the consciousness of the entrepreneur. The results are designed to assist in general all of those interested and especially addresses potential entrepreneurs from the Life Sciences: biologists, chemists, bio-technicians, pharmacists, etc. But also those, who are already in the middle of the planning phase or those, who are on the market will still find further important suggestions.

The seminar "working without risks"

The training modules are carried out in seminar-form. Hereby, entrepreneurs talk about their own experiences and answer the participants' questions afterward.

At past events the importance of, aside from keeping rules and regulations, paying attention to employee attitude toward this subject has become apparent. The following aspects came especially to light:

Thorough education and individual assessments of danger people could be sensitized for that topic.

In this way the consciousness about the importance of safety and health will be kept awake.

The steps that lead to a healthy and safe laboratory workplace are explained by professional advisors further along in the seminar.

The web presentation guides through the confusingly complex subject matter. Above all, the thorough collections of links make accessing information easier.

Time 16:00 - 18:00	**Activity**	**Materials**
Introduc- tion	**Welcome and presentation of the course, the European project and the teacher**	Overhead sheet
Part 1	**Introduction and determination of the topic**	Overhead sheet

Part 2	**Report of experiences from a biotech starter company**	
	Introduction to a biotech company. Biological test procedures involving testing the impact of toxins on the environment	PowerPoint presentation
	Presentation of practical examples from the laboratory along the following points: • Deficiencies caused by organisation • Deficiencies caused by workplace arrangement • Danger caused by materials • Danger caused by fire/ explosions • Biological danger	
	• What are the special company responsibilities? • What are the special co-worker responsibilities? • Joint company and co-worker responsibilities	
Part 3	**Input from the safety engineer**	Lecture, checklists
	Introduction to an engineering company dealing with management systems for work-related, environmental, radiation and health protection Integration of the company into the social system of health and work protection through optimised transfer of legal and administrative regulations into the areas of	

	health and safety, as well as in consumer and work protection	
	Provision and explanation of fitting checklists dealing with the topics: • Safety evaluation of laboratory workplaces • Work procedures for handling contaminated products • Evaluation of safety levels in laboratories	
Part 4	**Introducing important institutions**	Overhead sheet, Handout
	Introduction of the government safety organisations and their duties	
	Information for entrepreneurs of biotechnological companies	
Part 5	**Presentation of the website** • Regulations • Organisations • Checklists • Literature • Abbreviations	Handout
Part 6	**Closing the event** • Handing out the evaluation questionnaire • Passing around the attendance list	Questionnaire, attendance list

Training module office

Programme IDEAS (the entrepreneurship programme of the Universidad Politécnica de Valencia) has added this training module to its Entrepreneurship Support Workshops Scheme. Development of an training module for safety and health at the office workplace.

SUBJECT	KEY MESSAGES	MATERIAL
Opening	Welcome Presentation of the course Pre-test evaluation	
Objective: Attracting the whole group’s attention.	Questions to sensitize: • What aspects of this subject make you worry? • How many of you have ever thought about creating a company? • How many of you have already created a company? • How many of you have ever worried about health and safety at the office? • How many of you have made anything in the “health and safety at the office” arena? • How many of you have read the labour risks prevention law? • How many of you know the infractions contemplated in the law?	Pre-test questionnaire Power Point slides

	Make some "on the spot" statistics from the answers.	
Obligatory law Objective: Making people aware of the obligation.	Contents: • Fundamental law and norms • Responsibilities and penalties (minor, serious and very serious infractions)	Power Point slides. Photocopies of Spanish law
Even looking nice, it can be risky Objective: Reflection about appearance and safety.	Question for dynamism: • When visiting an office, who pays attention to safety aspects?	Demonstration of videotape
Risky factors Objective: Learning to notice the risky factors at the office.	• Workplace and installations • Chemical and biological agents • Work post conditions - equipment and postures • Environmental conditions • Psycho-social and organization conditions	Demonstrative videotape Register sheet (auditing annex) Power Point slides

Responsibility of the company, businessmen and founders themselves	Question for dynamism: What’s your responsibility as company founders? Who are you responsible for? • Your workers • Your clients • Your suppliers • Your partners • Yourself • Everybody in your workplace or who receives your products/services How can you execute your responsibility properly? Actions to prevent risks: • Plan risks prevention • Evaluate risks • Promote health and positive attitudes towards self safety and the safety of everybody working in the company • Informing • Training • Organize work and introduce new technologies • Implement risks control systems • Implement and maintain an updated emergency plan	Power Point slides

Bibliographic and internet references	• List	List
Evaluation and closing	• Post-test (knowledge valuation) • Satisfaction level of the course	Test

2.2 Web presentation

The website builds up the core of the project. It offers broad information and detailed checklists. It is multilingual, because the target group represents peoples from German, Spain an many English speaking persons.

Goals:

- The raising of consciousness and sensibility of potential founders of companies for safety and health when setting-up a company and at the workplace

- Make access to important information about the topic of safety and health at the workplace easier for those concerned and interested.

Relevant and numerous information sources have been prepared for the laboratory and office workplaces. Here one may find laws, ordinances, regulations, organisations, checklists, literature, many links and contact persons. General information that is relevant for other countries has been translated.

For example the part “Laboratory workplace“ at www.sh-ee.org was divided into five sections:

Rules: This menu item contains links to important laws, ordinances and technical rules all related to the topic of laboratory workplaces. With a mouse-click you can access the exact terms printed in the regulations.
On the first level, laws are the conversion of European rights to the national level. Laws formulate goals and ground rules.
Concrete information about each law can be found in the ordinances. They form the next level, whereby there are most often a number of ordinances for each law. The third level is composed by the technical rules. They contain direct operational instructions as they are used in the average work environment and are accordingly numerous. They form the foundation of a “regulation”-triangle that has a middle made of ordinances and the law on top as a pinnacle. In this way the European law finally breaks through the entire cascade of regulations.

Organisations: Here you will find contact persons who can further help you with general information, extra tips or special consultation on the topic of safety and health in the laboratory.

Checklists: What can and must be considered when furnishing, equipping and running a laboratory? Those who go through the checklists raise the chance of performing the job correctly!

Literature: Here you will find links to selected books. The links lead you directly to the publishers’ homepages where one can usually find ordering information.

Abbreviations: This list helps you to become acquainted with the judicial terminology. Here you will find officially-used abbreviations for all listed German laws, regulations and rules.

3. Feed back of the target group

The response based on the completion of the training units was positive in both countries.

The following specifics came to light:

More than half of the participants in Stuttgart und Tübingen stated, that they had only basic knowledge about the necessity of safety and health in the laboratory.

The guest speakers were received very positively. They were experts in their areas and knew the material well. The response about the website was also very good. A website with such main topics and such an information spectrum had not existed until then.

In the passed around questionnaires different suggestions were given for future events, for example:

- Documentation: practical examples

- It would be interesting to know, if one has the opportunity as a student to evaluate the safety of one’s own University’s laboratory
- How one may deal with chemical as well as biological material

The feedback from some participants was for example:

- “Excellent module”
- “The video films are excellent didactic tools”
- Links and references to public institutions related with H&S are very useful. “If the objective was to raise our awareness about H&S and our responsibilities, we got it”.

The Spanish partner did a pre and a post test to evaluate the rising of know how by the people attending the courses.

Description:

To make this evaluation, a short questionnaire has been developed and is given to the attendants twice along the workshop:

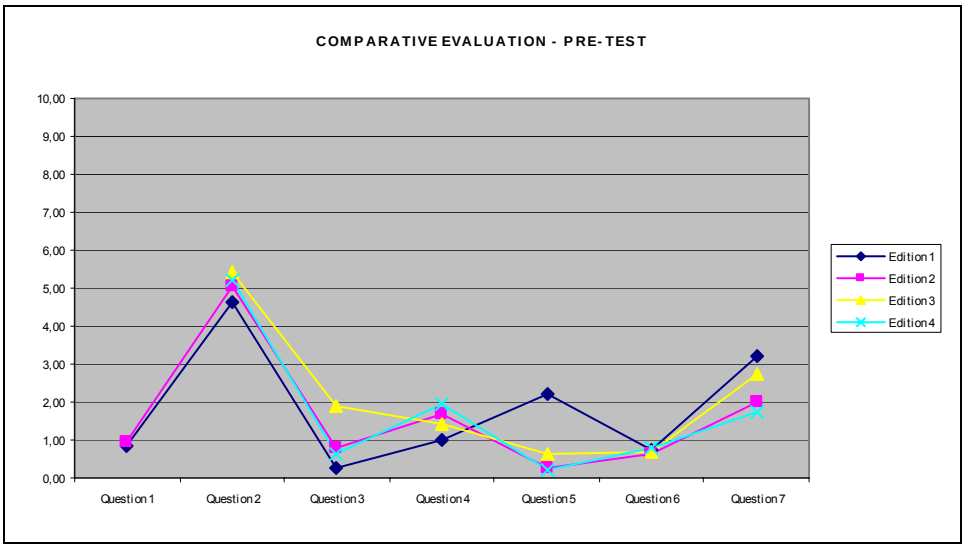
- At the beginning to know the attendants’ initial knowledge of the topic
- At the end of the training action, to detect any increase in their knowledge of the topic

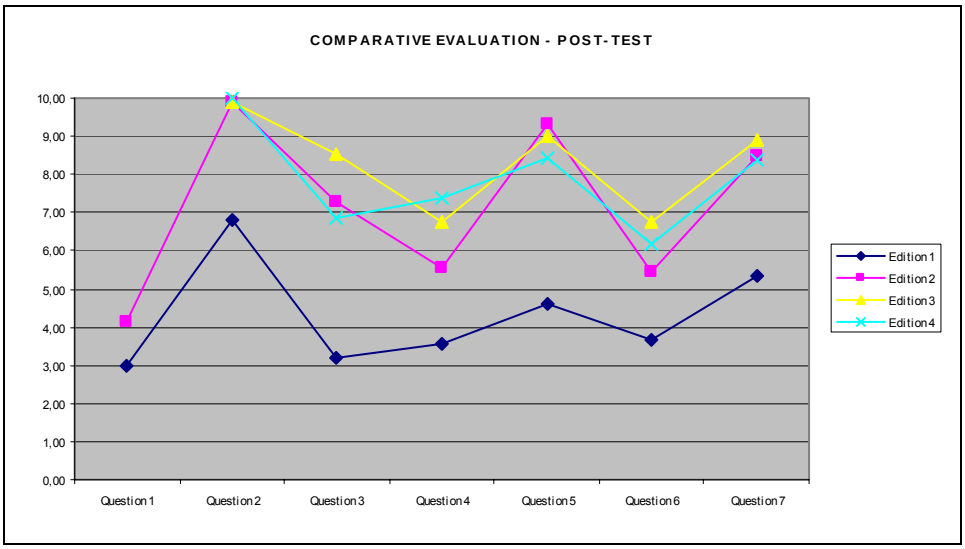
These were the questions in the questionnaire:

1. Express using your own words the information you have about the norms that reglement labour risks prevention.
2. Who must carry out the labour risks prevention law?

3. What kind of infringements does this law contemplate? Please specify their classification and criteria of it.
4. Which sanctions does this law impose?
5. Please enumerate the factors that must be taken into account in order to prevent labour risks at the office.
6. What aspects should a company owner contemplate to exercise properly his/her responsibility about labour risks prevention?
7. Please describe the positive aspects that can derive from implementing a health and safety at work system at your office.

They did totally four courses or so called "editions" with the following results:





4. Difficulties

There were no basic difficulties over the course of the project. It was not possible to attract the number of participants originally anticipated even though the course had been widely and extensively advertised.

A great reason for that is most certainly that the target group was limited from the beginning. The number of people that work in laboratories is much smaller than the number of those that work in an office.

The awareness for the necessity of safety and health at the workplace is not yet pronounced for this target group, in some parts, only barely existent. It doesn’t have priority as do finance and acquisition for example.

Only very few people become independent in the area of biotechnology.

The awareness among potential founders is only marginally sensitized to the topic of safety and health. This means that this area must be more heavily advertised using especially the currently developed products. According to the Spanish partners, it proved to be challenging in the office area as well on the first run to attract the planned number of participants. In order to solve this problem the following provisions have been made:

- Strengthened personal contact and personal addresses
- The integration in subsequent lectures
- Thorough training programme at university further educational academies
- Creating general awareness of this topic

5. Continuing

The results will be disseminated further by both partners. The following actions have been taken to continue the implementation.

Lectures: At the University of Hohenheim the chair of Agricultural engeneering is interested in implementing parts in his lectures.

NewCome.de (www.newcome.de): the official Internet portal for founding and company succession. The portal offers branch topics, target groups and regional-specific detailed information and services for founders, successors, and consigners in Baden-Württemberg. NewCome.de is a central meeting point on the Internet for these target groups. There the project is already presented and links are released.

Guss (Gesund und sicher starten) (Starting healthy and safely).
Goal of this cooperative project is to support aspects of safety and health in starting companies. This project creates close cooperation and at future events, the training modules and the website will be solicited for using mouse pads and brochures.

Programme IDEAS (the entrepreneurship programme of the Universidad Politécnica de Valencia) has added this training module to its Entrepreneurship Support Workshops Scheme. It is estimated to impart one H&S workshop each quarter, starting on 4Q03.

The importance of patents for university based start-ups

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Abstract

The paper, inserted in the growing literature on the economic and legal impact of university patenting, aims to analyze the recent legal and institutional changes in Germany regarding patenting and commercialization of university inventions. It compares them with the respective U.S. legislation and provides a critical view on empirical data about numbers of patents and start-up rates. From a German point of view, the paper shows several economic and legal dilemmas that go along with entrepreneurship by university patents, and explores possible solutions. Finally, it draws conclusions and suggestions for a university policy destined to the enhancement of university patents usage for new firm formation.

Keywords: University patents, Intellectual Property, Innovations, Technology Transfer, Entrepreneurship, Start-ups on patents

JEL: M13, O31, O34

I. Introduction

Universities play an important role in today's knowledge society. They have a central function in production of basic and applied research outcomes since academic research in fact covers the whole range of knowledge generation activities. Therefore, universities are traditionally considered as a principal source of innovation and technological change. Recent economic literature focuses attention to spillovers from university research (Romer, 1986; Dasgupta and David, 1987; Jaffe, 1989), which is crucial to economic activity increasing the efficiency of private sector and the total factor productivity (Barker, 1985; Adams, 1990; Rosenberg and Nelson, 1994).

In latest years, these spillover effects have been channeled throughout the commercialization of university-generated knowledge. Within this context, patents are shifting in the midpoint of public policy discussion regarding the role of universities in a future innovation system. The importance of patents as a unique and highly visible mechanism for transferring technological knowledge to the private sector (Archibugi, 1992; Basberg, 1987) is due to a variety of reasons. First, they are a classic and traditional as well as internationally recognized legal instrument for the protection of technological knowledge. Its widespread application surpasses easily all other intellectual property rights. (DPMA, 2004; USPTO, 2003). Second, because patents confer a series of exclusive monopoly rights that provide on the one hand effective protection against imitation and misuse, on the other strong incentives to put money in research if the investor can appropriate the economic returns from the respective results (Arrow, 1962). Given the fact that the majority of university inventions are embryonic and additional development is need to get them ready for commercial exploitation (Jensen and Thursby, 2001; Shane, 2004), incentives to encourage the necessary private investments are essential to transform these inventions into economic values. In addition to that, economic literature has shown empirical evidence of the benefits of knowledge spillovers from university patenting (Jaffe, 1989; Acs, Audretsch and Feldman, 1992, 1994).

Different ways are imaginable for the commercialization of university patents, namely licensing or sale to established as well as to start-up companies. However, due to their limited financial resources, start-up firms scarcely will be in the position to pay royalties or purchase a patent. Therefore, a vehicle to exploit university patents throughout start-ups is making an equity investment in them. This implies that universities bring their intellectual property rights as a minority share in newly founded firms, waiving royalties during the first years of its existence. There are multiple advantages of this proceeding. For universities, the sale of these business shares once the start-up has successfully established promises the generation of a higher return on capital than a short-term licensing or sale. Moreover, in doing so, universities promote entrepreneurial activities and contribute, so far, to economic growth. They also promote a real and rapid transposition of research outcomes into new marketable products and services, as established enterprises frequently are unable or because of "not here invented" syndrome not willing to embrace innovations, which could render their existing technologies obsolete (Bielig and Haase, 2004). For start-up firms, equity participation releases them initially from royalty or purchase price payments and attenuates so liquidity constraints new firms face with (Goldfarb and Henrekson, 2003).

In view of the extraordinary importance of university start-ups based on the commercialization of patents, the article in following section II explains the recent legal and institutional changes in Germany concerning university inventions. The results suggest that in German "top down" new university policy there are still some significant differences in legislation compared with U.S. legislation that served as an example. Section III examines the however imperfect empirical data from German Patent Exploitation Agencies ("Patentverwertungsagenturen" – PVA) and compares them with the respective data set of the Association of University Technology Managers (AUTM), indicating a huge divergence in terms of numbers on German and US university patents and their use for founding start-up companies. In section IV, the paper discusses several economic and legal dilemmas regarding

entrepreneurship on patents emanating from university research, and explores possible solutions. This includes the question whether patents from public funded research should be placed at exclusive disposal of start-up companies. The paper reveals that the "experimental privilege" in German Patent Act mitigates these exclusion effects limiting the patent scope to only commercial purposes, so that universities are allowed to continue researching patented inventions. Further, it deals with the conflict between traditional publication and new exploitation strategies throughout entrepreneurship on patents that may be solved reintroducing a "grace period" in European patent laws. Finally, German fixed and relatively high university inventor's share is stressed since it may obstacle new firm formation. The paper suggests that inventor's share should not refer to gross income and not be defined on federal but on university level, according to the quality of invention and its commercialization expectations. Moreover, university inventors should be more actively involved in decisions regarding patent exploitation strategies.

Section V provides concluding remarks and observations, which by virtue of the highly exploratory character of this article only can be suggestive. After all, the results are destined to enlarge the growing literature on the economic and legal impact of university patenting (Adams, 1990; Henderson, Jaffe and Trajtenberg, 1998; Thursby and Kemp, 2002; Siegel, Waldman and Link, 2003; Adams and Griliches, 1998), but seen from a German perspective.

II. Recent legal and institutional changes in Germany

In the face of the challenge to foster commercialization of scientific research output from the academic sector, German policymakers have reinforced the efforts to adapt legislation and to erect the necessary infrastructures. Although links between universities and industry, especially in former Eastern Germany, have certain tradition, a series of measures underlines the intention of German government to intensify this relationship promoting technology transfer to the private sector and the commercial exploitation of university inventions. A first

step towards this novel development portrays the amendment of the Federal Framework Act regarding universities ("Hochschulrahmengesetz" – HRG) in 1998. Herein, § 2 (7) HRG codifies knowledge and technology transfer as a further central function of German universities.

Beyond it, particular attention has attracted the recent renewal of the Federal Act governing employee inventions ("Gesetz über Arbeitnehmererfindungen" – ArbNErfG) . Prior to this revision, all rights on inventions resulting from academic research made by university professors retained to the latter ("Hochschullehrerprivileg"). Hence, they could decide solely about legal protection and commercial exploitation of their findings, but at the same time carrying all expenses and risks in case of patenting and commercialization. In accordance with the new § 42 ArbNErfG this university professor privilege was abolished, conferring the property rights on inventions arising from on-campus research to the universities rather than to the academic inventors. Furthermore, these inventions have to be reported to the university administration within a two-month period before their publication, which permits their commercial evaluation and legal protection. In case of patenting the inventor's share amounts to 30% of gross income generated by the commercial exploitation of the university-owned invention.

In 2002, the Federal Ministry of Education and Research ("Bundesministerium für Bildung und Forschung" – BMBF) launched an action plan, the so called "exploitation offensive" ("Verwertungsoffensive"), to create an appropriate professional infrastructure on universities for patenting and exploitation of patents (BMBF, 2001). In a first three-year period the universities were granted federal funding to create Patent Exploitation Agencies ("Patentverwertungsagenturen" – PVA), which offer expertise in legal and business sides of invention commercialization. This initial financing will be successively reduced to get theses agencies self-funded by the returns of patent commercialization pursuits within following years. The intended effects of these measures are on the one hand to give faculty staff strong

incentives for inventive activities and their registration relieving them from complex, expensive as well as time consuming patenting process and marketable evaluation of inventions, on the other to expand knowledge and technology transfer throughout patents (Bartenbach and Volz, 2002; Bartenbach and Hellebrand, 2002).

The model of this legal and institutional initiative in Germany – and also for similar measures in Denmark, the Netherlands, Sweden, Spain and Brazil (Goldfarb and Henrekson, 2003; Falck and Schmaltz, 2004) – was U.S. Public Law 96-517 ("Patent and Trademark Amendments Act"), the so-called Bayh-Dole Act, which became effective in 1981, as well as the 1984 passage of U.S. Public Law 98-620. These laws instituted a uniform policy that allowed universities very broad possibilities to retain property rights to inventions deriving from government funded academic research and to charge royalties of their intellectual property. The purpose of these acts was to keep the government out of the commercialization process and to incentive universities to set up their own technology transfer offices for the commercial exploitation of research outcomes (Henderson, Jaffe and Trajtenberg, 1998; Mowery, Nelson, Sampat and Ziedonis, 2001). In contrast to the later German legislation, this U.S. "bottom up" policy framework did neither dictate nor suggest specific rules and provisions opening space for experimentation in university policies (Goldfarb and Henrekson, 2003). In consequence, U.S. universities themselves have particular explicit regulations on reporting on inventions, assignment of patents, as well as inventor's share and income distribution throughout their commercial exploitation.

Even if the basic strategies – awarding property rights on inventions to universities rather than to the faculty inventor – are internationally converging, there remain some small but significant differences in German approach. While U.S. model is particularly focused on setting a policy framework that allows universities to experiment best practice (Goldfarb and Henrekson, 2003), German "top-down" institutional setting, in turn, defines quite strictly entitlement of university patents and commercialization income distribution. Next section

analyzes the available data set of German patent exploitation outcomes comparing them with the respective figures from of U.S. universities.

III. Empirical considerations on university patents

The record of German university patenting output is not only characterized by data constraints, it also varies considerably in view of the different studies and publishing institutions. Neither the twenty recently established PVA nor BMBF place regularly and detailed numbers of patent applications deriving from universities at public disposal. Thus, the respective data detection is difficult and its collection only approximate and incomplete. Some optimistic studies (Schmoch, Licht and Reinhard, 2000; BLK, 2000) estimate that every year about 2,000 up to 2,500 patent applications emanate from the academic sector. This corresponds to just 4% of overall number of patent applications filed by German Patent and Trademark Office ("Deutsches Patent- und Markenamt" – DPMA), which in 2003 amounted to 64,518 applications (DPMA, 2004). Others (Bartenbach and Volz, 2002; Post and Kuschka, 2003) proceed on the more realistic assumption that merely 2% of all DPMA patent applications arise from German universities, in figures about 1,250.

In fact, recently published and presumably only official data communication of BMBF reveals that PVA registered 528 patent applications in second half-year of 2003, what means an increase of 17% within the previous 12 months (BMBF, 2004). This corresponds to approximately 1,000 or 1.5% of all DPMA patent applications per year. In comparison, in fiscal year 2003 solely Siemens AG with 3,949 (DPMA, 2004) filed about four-times more patent applications than the total of all German universities. Regarding start-up activities based on university patent commercialization, in Germany there exists no systematic and official data record at all. One empirical study (BMBF, 2002) shows that on average 50 start-ups per year utilize university patents. Supposing realistic patent grant rates of 40% up to

50% allows the conclusion that nearly 10% of all German university patents are commercialized by founding start-up firms.

In the USA, since 1991, AUTM surveys annually its members and publishes the collected data on university patenting and licensing in a Licensing Survey. While in 1980 there were only 300 patent applications (Abramson, Encarnação, Reid and Schmoch, 1997) from the academic sector, in 1991 already 1,643 and in 2002 exactly 7,741 patent applications were reported by 219 U.S. universities or related institutions, an annual increase of 13.6% compared with 2001. Herewith, U.S. universities contribution amounts to 2.3% to totality of patent applications in USA (USPTO, 2003). Concerning the foundation of start-up companies, 312 of such new firms were created with equity investment in 2002. Throughout the establishment of new companies an average of just 10% of U.S. university patents is regularly commercialized (AUTM, 2003).

It is worth to notice that according to the AUTM surveys university patenting and its commercial exploitation have exploded over the last twenty years. At first glance, this propensity appears to be an important response to the legal changes in U.S. university and public policy in 1980 and 1984 (Link, Scott and Siegel, 2003; Shane, 2004). In spite of that, some researchers found that these alterations, above all the Bayh-Dole Act, have exercised only little effect on university patenting (Henderson, Jaffe and Trajtenberg, 1998). In contrary, they have been especially due to governmental efforts and judicial decisions towards stronger intellectual property rights as well as to the growth in federal financial research support (Jaffe, 1999; Mowery, Nelson, Sampat and Ziedonis, 2001, 2002).

In contrast, even tough in terms of international scientific publication measures German professors and researchers are well positioned, their university patenting performance has still huge deficits (Haase and Lautenschläger, 2004). Compared with other developed countries, Germany entered quite lately and labouredly into a new university innovation policy. Although university patenting and corporation with private sector in Germany began

quite some time ago, up to now, the response to the legal and institutional changes is rather modest and delays in gathering momentum. Referring to start-ups based on university patents, the proportion in Germany is indeed similar to the USA, but in absolute figures, the current output from German universities corresponds only to a sixth part of the respective U.S. performance.

These large differences are owed to a variety of reasons. Legal, economic, and cultural aspects influence them. Next section deals with some of the dilemmas that have an important effect on founding start-ups on university patents, seen from a German perspective.

IV. Several dilemmas regarding entrepreneurship on university patents

1. Scientific knowledge as private vs. public good

With regard to legal protection of academic inventions and their commercial exploitation, a dilemma lies in the question if public funded patents could be exclusively placed at the disposal of a start-up company, while other participants in the market remain excluded from the use of the patented technology. Herein, the fundamental issue consists in whether these patented findings have to be considered private, defined by both rival usage and exclusion of others from possession, or public good, in economic theory characterized by non-rival usage and non-exclusion. Because of specific reputational reward system of international scientific community, where an early and non-costly public disposal of research outcomes is crucial for obtaining recognition, but also due to particular characteristics of German universities, where research is predominantly public financed and teaching is free of charge, scientific knowledge is generally considered public good (Bielig and Haase, 2004). Obviously, such attitude may extend to legal protected technological knowledge, so far also to university patents.

This stands in conflict with the in section II. mentioned legal initiatives, which also allow German universities to appropriate the property rights on inventions resulting from academic research and their commercialization for own benefits. This privatizing may restrict, at the

same time, the public access to scientific research outcomes, which in fact degrades significantly the effectiveness of the entire research system (David, 2003). Nevertheless, German patent law, as well as most European ones, provides a solution that can considerably mitigate those negative effects. Namely, § 11 (1) of German Patent Act ("Patentgesetz" – PatG) restraints the scope of the conferred patent rights to purely commercial purposes, and § 11 (2) PatG allows the experimental use of the patented invention, the so-called "experimental privilege". These provisions except private, non-commercial as well as experimental usage of patented technological knowledge from patent holder's exclusion rights. Hence, the meaning of § 11 (1) and (2) PatG is fundamental for research activities, because it embodies the idea that patents shall not obstacle R&D and, therewith, the scientific and technological progress. Furthermore, it is one basis that, at least in Europe, patenting in the academic sector is not shifting to a patent race following the principle "the winner takes all".

2. Publication vs. protection

Another difficulty concerning the use of university patents for start-up activities – similar to those mentioned above – lies in the conflict between rapid publication interest by academic scientists and legal protection strategies attempted by university administration. Although both concepts lead to a disclosure – in case of publication immediately, in case of patenting after 18 month – of new research outcomes, they are, especially in Europe, in a heavy contrast. Scientific community is traditionally characterized by specific norms, participant's acting and incentives, which it distinguish from other economic or social subsystems. Hereby, the evaluation of new knowledge depends on an active involvement of and interaction with other researchers, which either discard it if unreliable or confirm and bring it into conjunction with other knowledge inducing new findings. In its central focus stands a specific, reputation-based and non-market reward structure that builds on "scientific priority" as well as quality and number of publications, rather than on gaining patents. By this, being

recognized by the scientific community is crucial to receive tenure, to gain grants and to enter in networks (Buss and Wittke, 2001; David, 2003). Regarding these circumstances, researchers often prefer an early publication, which is reinforced by high bureaucratical, temporal, and financial efforts that are going along with patenting, as well as the ignorance of legal protection possibilities (Bielig and Haase, 2004).

This publication strategy not only acts against the new public policy on the enhancement in patenting and commercialization of academic research results; in Europe it even impedes their later legal protection, since in European patent law there exists no "grace period". European patent law requires the absolute novelty of an invention, for what reason a patent application made after the publication of the invention has to be rejected by the Patent Office, although this occurred by the same person. In contrast, U.S. Patent Law provides a "grace period" of 12 months that makes such considerations obsolete.

To solve this problem there are two possibilities: The (re)introduction of a "grace period" in European patent law or the promotion of the so-called "provisional patent application". The latter ensures patenting when an imminent public presentation of the invention i.e. at a conference is planned. But owing to the fact that the (often rapid and low-quality) disclosure in the "provisional patent application" is decisive for further description of patent claims, this form of patent application indeed can only be conceived as an emergency measure.

A better way to avoid an application failure due to the invention's former publication consists in granting a "grace period". In such case, within a pre-established period of mostly 6 or 12 months, which some time ago existed also in German Patent Law , an invention's publication made by the original inventor does not hinder subsequent patenting. Policymakers, therefore, should consider the (re)introduction of a "grace period" in European material patent law dispositions, whose absence means a significant disadvantage for European universities in obtaining patents for new technological findings.

At the same time, a special provision of German Federal Act governing employee inventions may obstacle the reporting and patenting of university inventions. The so-called "negative publication clause", determined in § 42 (2) ArbNErfG, grants university professors and researchers a right to keep their inventions secret. This regulation is due to Art. 5 (3) German Constitution that guarantees, with regard to content, the independence in teaching and research of full professors at universities. However, it offers a gap in German legislation on university inventions that does not exist in other countries and that is adverse to the main objective in the new university policy (Bartenbach and Hellebrand, 2002), which is the promotion of patenting of research outcomes and subsequent commercial exploitation throughout start-ups.

3. Licensing and sale vs. equity participation

In the presence of these new targets in university policy, other, especially economic constraints may influence university's decisions on how to commercialize their intellectual property. From an economic perspective, patenting is worth incurring only if the revenues from commercialization exceed the administrative and legal costs imposed by patenting. Although making equity investments in start-up firms throughout patents the universities could maximize their income, this way is also linked to greater risks than licensing or sale, because the return on capital may delay or suffer losses. Moreover, financial subsidies offered by "exploitation offensive" of BMBF (BMBF, 2001) to create an professional infrastructure for patenting and exploitation of university patents go on at the most for six years. However, experiences from USA demonstrate that the construction of such networks will take at least ten years. For those reasons, German university administrations, which decide solely about commercialization strategy configuration, will prefer a rapid and more secure redemption of patenting costs by licensing and sale to established companies, rather than an equity participation in a start-up firm (Bielig and Haase, 2004).

This is underpinned by the fact that German university inventor's share refers to gross instead to net income generated by commercial exploitation of the invention. By means, they will receive their inventor's share even if the economic returns from commercialization of their inventions do not lead to a redemption of research and patenting costs (Bartenbach and Volz, 2002; Bartenbach and Hellebrand, 2002). Hence, the willingness and motivation of German universities to bring their intellectual property in start-up firms is fairly limited, which stands in conflict to the objectives of new university policy.

The analysis of German federal legislation governing employee inventions in section II. revealed that in case of patenting university inventors with 30% receive a fixed and relatively high share on income generated by the invention's commercialization. In comparison, the U.S. university inventor's share is not determined by federal law and varies in order to individual university policy dispositions. Some studies show that the majority of U.S. universities have linear schedules of remuneration, or rather a fixed percentage in the range between 30% and 50%, discounting administrative and patenting costs (Thursby, Jensen and Thursby, 2001; Falck and Schmaltz, 2004). Other U.S. universities have established non-linear recompense schedules that depend on the level of income generated by invention's commercialization (Lach and Schankerman, 2003).

These extensive inventor's shares on sales, licensing and equity participation revenues are destined to encourage inventive activities in academic institutions and reporting of respective inventions. Some authors even proved that universities with higher inventor's shares generate higher levels of license income, which signifies that academics respond to monetary incentives (Lach and Schankerman, 2003). In spite of that, the distribution of a high percentage on invention's commercial exploitation income to inventors may disincentive start-up activities. Di Gregorio and Shane (2003) found that universities with lower inventor's share of royalties are more likely to produce new firms. On the other hand,

university policies of making equity investments in start-up companies have a positive effect on new firm formation.

In consequence, the design of university policies regarding patenting strategies and inventor's remuneration is crucial for the enhancement of start-up activities. Thus, these policies in Germany should be flexibly defined on university level according to the quality of invention and its commercialization expectations (Bielig and Haase, 2004). The definition of those commercialization strategies should go along with an active involvement and participation of university inventors, since they can assess the practical usage of their invention. In addition to that, in doing so, universities can avoid further disputes with inventors in case of commercial exploitation failure or delay (BLK, 2000).

V. Conclusion

The recent legal and institutional changes in Germany concerning university inventions attempt to enhance patenting and commercial exploitation of university research outcomes. Even if their the main idea, awarding property rights on inventions to universities rather than to the faculty inventor, is similar to international tendency, there are still some significant differences in comparison with the respective U.S. legislation. Thus, German approach represents an institutional, legal, and financial "top down" policy framework, especially on entitlement of university patents, commercialization income distribution and financial subsidies. In spite of all efforts, comparing with other developed countries, German university's numbers of patents and their use for founding start-up companies is rather modest and delays in gathering momentum.

There are several economic and legal dilemmas and restrictions regarding entrepreneurship on university patents. This includes the question whether patents from public funded research should be placed at exclusive disposal of start-up companies. The paper reveals that the "experimental privilege" in German Patent Act mitigates these exclusion effects limiting the

patent scope to only commercial purposes. Thus, universities are allowed to continue using patented inventions, which is fundamental for research activities, because it embodies the idea that patents shall not obstacle R&D and, therewith, the scientific and technological progress.

Furthermore, the paper deals with the conflict between traditional publication and new exploitation strategies throughout entrepreneurship on patents, which may be solved reintroducing a "grace period" in European patent law. At the same time, the so-called "negative publication clause" of German Federal Act governing employee inventions may obstacle the reporting and patenting of university inventions, since it grants university professors and researchers the right to keep their inventions secret.

Finally, the duration of financial subsidies offered by BMBF "exploitation offensive" as well as the German university fixed and relatively high inventor's share should be considered since it may hinder new firm formation. German university administrations will prefer a rapid and more secure redemption of patenting costs by licensing or sale to established companies, rather than an equity participation in a start-up firm. It is important, therefore, that inventor's share should not refer to gross income and be not defined on federal but on university level, according to the quality of invention and its commercialization expectations. Moreover, university inventors should be more actively involved in decisions regarding patent exploitation strategies.

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Reflection on Integrating University Based Start-Ups of China into International Network

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Abstract

Based on the history of university based start-ups of China, this paper points out the necessity of integrating the start-ups into international network. It shows that university based start-ups of China usually have difficulties in linking with international network because of their own weaknesses and the barriers in the process of international cooperation. To overcome the difficulties, the start-ups and the Chinese government are advised to take some measures.

Key Words: university based start-ups; international network; international cooperation; technology transfer; strategic alliance

INTRODUCTION

Since the end of 1970s, the enterprises or ventures with the background of university supports have come forth in China. These university based start-ups are closely related to the development of Chinese universities and thus have their distinctive characteristics. The development of university based start-ups of China can be roughly divided into three stages: (1) From the end of 1970s to the middle of 1980s, products or services provided by most

university based start-ups were not involved much with high technology. (2) From the middle of 1980s to the early of 1990s, the start-ups manufactured high-tech products and expanded their scales to some extent by commercializing some inventions of universities. (3) Since the middle of 1990s, Chinese government has regarded the performance of university based start-ups as one of indicators evaluating universities, and thus more and more universities has taken advantage of their strengths in preponderant disciplines to develop university based start-ups. A large volume of small and medium-sized high tech enterprises based on universities has sprung out. And at the same time, some start-ups with large scale, huge capital, and high technology come into being. High-tech start-ups have become the main body of university based start-ups and made a significant contribution to universities. In 2002, 2216 university based high-tech start-ups of China had 53.9 billion RMB sales income and 1.8 billion RMB net profit, submitted 2.6 billion RMB tax and shared 0.7 billion RMB revenue with universities (Yang, 2002).

The establishment and development of university based start-ups of China have been driven by both demand pull and supply push. On the one hand, the social demand pulls universities to establish start-ups. As most enterprises in China do not have strong ability to conduct R&D activities and there are not enough agencies to transfer technology, enterprises are hard to directly absorb universities' inventions. Compared to other kinds of enterprises, university based start-ups are more likely to have much room to develop and to achieve technical innovation if the universities can capture their advantages in science and technology and grasp market opportunities. On the other hand, the development of university per se pushes the establishment of university based start-ups. In a planned economy, government funding was the major financial source for universities. However, government funding for universities is far less than that required in a market economy. Many universities have begun to run for-profit enterprises directly. For example, the Founder Company, which has a significant share

of the domestic software market in China, was begun at, and is controlled by, Peking University. By directly engaging in market activities, universities have changed from the role of pure research or teaching institutions to active market players so as to obtain additional financial supports. Besides financial benefits, university based start-ups help universities to remove some of redundant staff and act as a base for university staff and students to apply their knowledge to real commercial world.

In China, university based start-ups used to be regarded as an accessory of university, which restricted the development of the start-ups. With the development of market economy in China, the issue of how to properly position and manage university based start-ups has aroused the interests of both practitioners and academic researchers. Prior research (Bao, 2001; Li, 2001; He, 2001) focused on the relationship between university based start-ups and universities or the competition between the start-ups and the domestic firms in the same industry. There is little research on university based start-ups' involvement with international collaboration. After China's entry into WTO, this neglected topic deserves the attention and exploration of researchers and practitioners, because the management of university based start-ups is conducted in a global environment. This paper will point out the necessity of integrating university based start-ups of China into international network by analyzing the benefits of international cooperation. It will show the difficulties that university based start-ups of China usually have in linking with international network. To overcome the difficulties, the start-ups and the Chinese government are advised to take some measures.

THE NECESSITY OF INTEGRATING UNIVERSITY BASED START-UPS INTO INTERNATIONAL NETWORK

Integrating university based start-ups into international network means university based start-ups of China should form stable and lasting relationships with foreign universities or firms through interactions or collaborations. International interactions or collaborations can be in

the form of academic communication, technology licensing, technical cooperation contract, joint R&D center, or joint venture. Through linking with international network, university based start-ups can accelerate the speed of technical innovation and operate in a global standard.

To Enhance the Technology Level of University Based Start-Ups

Compared to other organizations, universities usually have stronger capabilities in basic and applied research and more talents of science and technology. In China, about 60% technicians engaged in basic research and 70% technicians engaged in applied research are university staff. R&D funds of universities amounts to nearly 40% of the national R&D funds. By establishing start-ups, universities combine the process of creating technological fruits with that of absorbing the fruits and thus reduce transaction costs in technology transfer. A university based start-up can be regarded as a good form of university-industry combination. However, there is still much room for universities in China to enhance their capabilities in science and technology. Most universities lack long-term, large-scale, and creative projects and commercialize only 10% of their inventions (Li and Luo, 2003).

Linking with international network will enhance university based start-ups in both creating and absorbing technological fruits. Through interacting and communicating with foreign researchers or technicians, people in university based start-ups could reach the academic and technical frontier to accumulate new technologies. Obtaining the information on R&D provided by international network, university based start-ups could avoid unnecessary investments on mature technologies, strengthen the contacts with international patentees, and speed up international technology transfer. Forming strategic alliance is another important way for university based start-ups to link with international network. A strategic alliance may bring complementary resources to each party. University based start-ups of China have abundant and cheap high-tech talents and reliable local market information, while foreign

organizations usually have advantages in technology and capital. Forming strategic alliance with foreign partners, university based start-ups of China could get enough financial or technical supports to achieve the innovation.

To Enhance the Management Level of University Based Start-Ups

The management of university based start-ups covers multiple processes (such as basic research, applied research, market research, product development, manufacturing, and marketing) and motivations to multiple groups of people (such as technicians, workers, and salespersons), which requires the start-ups to have quite great capabilities in management. At present, most university based start-ups are short of business talents who can play an active role in both technology and market innovation. And the coordination among departments and processes is not done well. Integrating into international network provides the start-ups with a learning mechanism, that is, learning by doing. Through international cooperation, the start-ups could learn about advanced management approaches from foreign partners, synergize technology exploration and market exploitation, and operate business according to the global standard.

To Expand University Based Start-Ups' Markets

Besides contributing technical and financial supports, integrating into international network provides university based start-ups with some intangible asset. To some extent, cooperating with famous foreign universities or multinational corporations can magnify a university based start-up's reputation in the local market, since international cooperation demonstrates to the public that the start-up has some strengths or advantages to be selected as a partner by foreign organizations. Furthermore, cooperating with foreign organizations in R&D makes it possible for a start-up to produce products with super technical qualities. Hence, the start-up is more likely to build up their brand name and gain market recognition.

Prior research (Johannisson et al., 1994; Sapienza et al., 1996; Hills et al., 1997) found that networking allows entrepreneurs to enlarge their knowledge of opportunities, to gain access to critical resources such as finance and to deal with business obstacles. Integrating into international network provides university based start-ups with social capital, that is, personal relationship with foreign professionals in the same industry or related industries. With such kind of social network, the managers in the start-ups broaden their visions and are sensitive to foreign market opportunities. And formal inter-organizational relationship may facilitate university based start-ups to enter foreign market. For instance, in 1997, IBM and Founder Corporation signed a contract for software development and global cooperation. Founder Corporation cooperated with IBM in developing software and at the same time sold its software through IBM's global market channels.

THE BARRIERS TO INTEGRATING UNIVERSITY BASED START-UPS INTO INTERNATIONAL NETWORK

At present, there are not many university based start-ups of China closely integrated into international network. Start-ups carrying out international cooperation and interaction are usually based on famous universities. Even those start-ups based on eminent universities do not conduct international collaboration broadly and deeply. This situation is due to the current status of university based start-ups and the barriers in the process of international cooperation.

Barriers Caused by the Current Status of University Based Start-Ups

Ambiguous property right and nonstandard management mechanism.

For most university based start-ups, universities are assuming their legal persons and intellectual contributions of university staff or technicians are not evaluated as a component of capital. As the only owner of a start-up, a university has to undertake all the risks of the start-up. There is no clear boundary between the university's property right and the start-up's

property right. Many universities interfere with the start-ups' business decisions (Li, 2001). The top managers of a start-up are usually technical talents or even administrators of the university. Such kind of top managers lack of business experience. Commercially inexperienced academic inventors may focus too much on the technical aspects of the innovation to the detriment of business dimensions (Daniels and Hofer, 1993).

As the university's administration is not fit well with the objectives of the start-up, the start-up is hard to operate in a market-oriented way. Ambiguous property right may cause some barriers to integrating a university based start-up into international network. First□the university's interfere with the start-up's business operation restricts the start-up's flexibility in dealing with the relationship with foreign partners. Second, because of not identifying intellectual contribution as a part of property right, technicians and managers in the start-up are not motivated to take initiative in international cooperation.

The scales of university based start-ups go to extremes.

There is a trend that the scales of university based start-ups go to extremes. On the one hand, some start-ups have developed dramatically and become large-sized enterprises in their industries. Currently, there are nearly 40 high-tech university based start-ups listed in Shanghai and Shenzhen stock markets. Take Founder Corporation as an example. Founder Corporation based on Peiking University now has fixed capital of 0.4 billion RMB, with 30 subsidiaries and 7 joint ventures. On the other hand, most university based start-ups are small-sized enterprises and with small amount of investment from universities. It is common for many universities that one invention brings about the establishment of one start-up.

Large-sized start-ups and small-sized start-ups confront with different barriers in international cooperation. Large-sized start-ups are always in leading positions in local markets. These start-ups usually do not have pressing desire to improve technology or conduct international cooperation since they have stable profits and many potential domestic partners. Some large-sized start-ups diversify their businesses and do not focus on their

original technical expertise in one field. Diversification makes international cooperation hard to be carried out in depth. The problem with small-sized start-ups is that they usually focus on gaining short-term profits and often neglect long-term strategic planning. Because the development of small-sized start-ups only depends on one or few inventions rather than continuous creation process, small-sized start-ups have little attractiveness in technology development and thus have fewer chances to form international technological alliances.

Barriers in the Process of International Cooperation

The form of international cooperation is an important decision for university based start-ups, as it is closely related to the aim of collaboration and determines the way of gaining profits for each party. International collaborations conducted by university based start-ups are mainly in two ways: technology transfer and strategic alliance. The former strengthens exogenous technological innovation, that is, to acquire a source of technology and knowledge through introducing or imitating technology. The latter benefits endogenetic technological innovation, that is, to acquire a source of technology and knowledge through leveraging an enterprise's own technological capability.

Barriers in the process of technology transfer.

Due to the proprietary nature of technology, there exists information asymmetry in the process of technology licensing. It is hard for university based start-ups to judge the degree of advancement of an introduced technology and to balance the royalty fees with potential benefits of the technology. And the purpose of technology transfer cannot be achieved until an introduced technology is assimilated and innovated by the receptor. According to a survey conducted by National Bureau of Statistics of China (Du, 2003), in 2001, the ratio of introduced technology over assimilated technologies in China's high-tech industries was 1: 0.047, which is much lower than that in Japan and Korea (whose ratio was about 1:3). Lacking investment on assimilating introduced technology, university based start-ups tend to

fall into the trap of "introduce technology---- lag ----- introduce technology again ---- lag again".

Barriers in the process of strategic alliance.

Strategic alliances formed between university based start-ups and foreign partners are involved with relatively tight cooperation in technology, manufacturing, or marketing. Therefore, mutual trust is indispensable to the success of strategic alliance. However, different national cultures and corporate cultures lead to differences in values and norms and thus always cause conflicts and distrust in the process of international strategic alliance. Sometimes, alliance partners do not reach the agreement on the degree of sharing knowledge and technology. If partners do not share the same strategic objective for an alliance, they may try to protect their own core competences so as to avoid the potential harm done by their partners. In addition, brain drain in the process of international cooperation is another worry of university based start-ups of China. Good working environment and welfare provided by foreign organizations have attractiveness to Chinese employees. The turnover of excellent researchers will be a great loss to university based start-ups.

HOW TO ACCELERATE UNIVERSITY BASED START-UPS' LINKING WITH INTERNATIONL NETWORK

Adjust the Relationship Between Universities and the Start-Ups

To carry out international cooperation proactively and effectively, university based start-ups should be on the right track of development by well dealing with the relationship with the universities that they based. The tangible and intangible assets that a university has invested on a start-up should be evaluated objectively so as to make the property right of the start-up clear. University based start-ups should be encouraged to operate independently in different forms. Large-sized start-ups with advanced technology can be reformed in a form of stock company or company of limited liability. Large-sized start-ups must standardize their

management and achieve further development by establishing three boards (that is, board of directors, board of supervisors, and board of stockholders) and implementing scientific decision procedures and effective motivation systems. Small-sized start-ups can be rented or sold so as to give the proprietors of start-ups more incentives and flexibility in business operation (Bao, 2001).

Build Core Competence and Strengthen the Notion of International Cooperation

University based start-ups ought to have a strategic planning and focus on building core competences. Depending only on mature technology can not guarantee the start-ups' success in the long run because mature technology might be obsolete with competitors' upgrading technology and the saturation of markets. University based start-ups should increase investment on R&D to generate more inventions. With the demand of pursuing new technological fruits, a start-up will have incentives to link with international network as international cooperation is a way to obtain a source of technological fruits. On the other side, the importance of building core competences lies in the fact that start-ups with core competences are more likely to be integrated into international network. The start-ups with core competences may have distinct technology resources or market resources which attract potential foreign partners. The start-ups with core competences may have clear objectives and abundant financial resources to introduce foreign technologies.

Select Appropriate Form of Cooperation and Overcome Barriers in the Process of Cooperation

University based start-ups should select an appropriate form of international cooperation according to their own situations. If tremendous expenses are needed to develop a technology internally, if introducing a products to market is impressing, then technology transfer can be used. If a start-up has great strengths in R&D or market development and can find ideal

foreign partners who can contribute complementary resources, then forming strategic alliance is a better choice.

In the process of technology transfer, university based start-ups need to search new technology roundly and detect new directions of competitors' technological innovation regularly. In this way, advanced technologies with great potential market value can be introduced. And the start-ups need to input more in assimilating introduced technologies so as to transfer introduced knowledge into their own capabilities. In the process of international strategic alliance, it is essential to integrate teams with different cultures. Members of one team are encouraged to communicate with members of another team with different culture. Managers engaging in an international alliance must be good at obtaining internal and external information and synergizing team members' cultural differences. Managers' good ability in communication and coordination is a key to avoiding conflicts.

Establish a Good External Environment for International Cooperation

In 2002, Chinese government's eight departments, such as ministry of education, state economic and trade commission, and ministry of finance, jointly enacted and implemented "An Guidance to Peiking University and Qinghua University about Standardizing Their Start-Ups' Management". The reform focuses on clarifying the property right and establishing a scientific management system for the two start-ups. It shows a direction to the development of other university based start-ups of China. Chinese government has approbated 6 universities' technology transfer institutes as national centers of technology transfer. State Economic & Trade Commission (2001) clear stated that one of main tasks for these national centers of technology transfer is to reinforce international cooperation in technological innovation, that is, to take an active part in international technology transfer, to facilitate assimilating introduced technology and developing technology, and to support Chinese students aboard to establish ventures or conduct R&D in China. All these measures taken by Chinese

government have good effects on integrating university based start-ups into international network.

As a majority of university based start-ups of China is in technology-intensive industries□the environment of high-tech industries will indirectly influence university based start-ups' linking with international network. Therefore, in addition to helping the start-ups to overcome barriers to international cooperation, Chinese government need to create a good external environment for technology-based enterprises. First, the government should enact a series of policies encouraging high-tech enterprises to innovate technology. For instance, high-tech enterprises should be allowed to have some preferential treatments in finance, or to get credit for exporting their products into global market. Second, through developing related agencies, the government need to establish a national service system for commercializing universities' technological fruits. The national service system will provide university based start-ups with services or supports in technology information, venture capital, trade of technology property, and training of business talents. Finally, the government ought to reinforce some statutes or laws to protect intellectual property rights which are owned by partners of international cooperation.

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Building knowledge economies in new EU countries: A study of the "Sunrise Valley" cluster, Lithuania

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Abstract

The study applies Harvard's Prof. M. Porter's theory of competitive advantage and the cluster approach to the context of building the knowledge economy in a new EU member such as Lithuania. From a strategic and comparative international perspective, the study evaluates conditions for building a knowledge economy (e.g. The Sunrise Valley, Vilnius University) in Lithuania in the broader context of global and European integration. Porter's "diamond" is used to evaluate Lithuania's and other countries' efforts at building the knowledge economy clusters; some broader strategic and some tactical/practical conclusions are offered, especially at the intersection of government, business, and society.

Introduction: Theses for the Study

As a Senior Knowledge Economy Advisor, I am now working on The European Bank for Reconstruction and Development (EBRD) sponsored mission to advise The City of Vilnius re long-term capital development based on knowledge economy, related entrepreneurial development issues as exemplified by the Vilnius-based Sunrise Valley (SV) cluster. The SV is still a project in progress but elements of it, esp. The Laser Research Center (USD10 million of international operations), Expla, biotech firms (e.g. Biotechna, with patents internationally), ITC firms, etc, are already well advanced, in some cases internationally.

Also, I have been occasionally advising the constituent stakeholders of the SV cluster (Vilnius University, Vilnius University of Technology, Lithuanian Academy of Sciences, levels of government, various private interests, etc) re SV conceptual development, planning, and venture capital mobilization globally. In 2002, 10 Lithuanian political parties and 14 non-profit organizations (representing business, academia, and youth organizations) signed a National Agreement concerning economic and social development. The priority of the National Agreement is the transformation of Lithuania's economy into a competitive knowledge-based economy, ensuring a variety of knowledge-based jobs as well as a compatibility of the education and science system with a developing knowledge-based society of Europe. Based on that Agreement, there are some forward-looking initiatives in Lithuania (e.g. Window to the Future, The Knowledge Economy Forum) that in some ways lead the new EU economies. Overall, Lithuania leads the new EU countries in terms of science & engineering graduates as a percentage of all university graduates.

My above conclusions are based on my international comparative “hands-on” knowledge of such clusters in a number of transforming policy environments, e.g. City of Tampere, Finland, some Polish, Canadian, US clusters, etc, and on my research, graduate teaching, and PhD supervision in the fields of entrepreneurship, knowledge engineering & management, and the global economy in general.

The Changing Institutional Wisdom

As the conventional Bretton Woods wisdom has it, macro stabilization and privatization is important. This is a conditio sine qua non. But this is not enough by far. Moreover, the conventional wisdom inspired beliefs in the universal omnipotence of macropolicies, esp. the monetary policy, are misguided fallacies in some cases bordering on intellectual fraud. And not just "intellectual" in many cases, because such "wisdom" in large part underpinned the

financial scandals in the last years (Enron, Parmalat, etc). And the institutional fit of these policies matters a lot. The most important influences on the micro level are determined not by formal privatization but by the nature of institutions in any given region or society.

Clusters: Definition

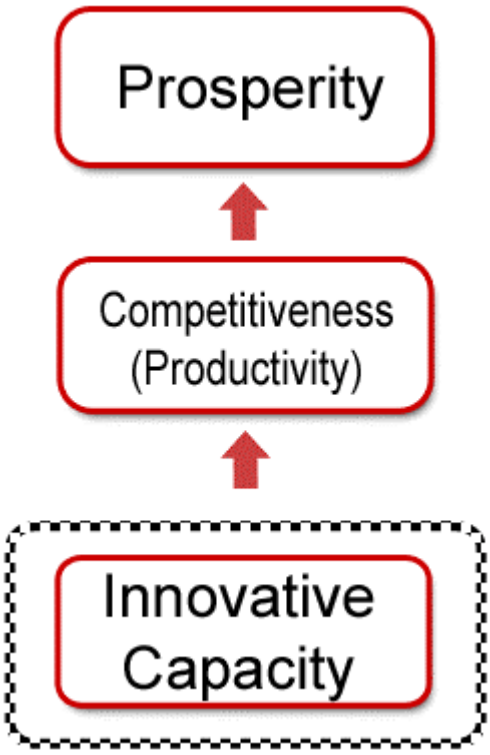
The cluster is a business agglomeration producing the critical mass of geographically proximate and linked businesses, industries and institutions--from suppliers to associations to universities to government agencies--that enjoy unusual competitive success in a particular field or fields. Cluster members are linked by commonalities and complementarities. As the value of the cluster is greater than the sum of its parts (all individual companies or institutions, etc), clusters create synergy that raises productivity and competitiveness in the final analysis.

From Macro to Micro

Governments and macro institutions have traditionally (esp. in Europe, USA) focused on the importance of the role played by fiscal and monetary policies in the competitiveness of a region (Washington Consensus) in spite of the fact that it is microeconomic policy that creates prosperity in a region or country.

A solid macro economic policy only paves the way for productivity, it does not improve it. This first diagram demonstrates how, through the application of micro economic policies, productivity can be improved.

The theory progresses with the introduction of innovation and the importance it has within an industry. The diagram depicts how the level of productivity of a region is mirrored in that region’s development (standard of living), where a steady, sustainable growth is required to maintain a high standard. In advanced regions like Europe, prosperity is influenced by a continuous rate of innovation, especially the sustainable innovation.



Prosperity in a region is created by the microeconomic foundations of competitiveness, which is based on the sophistication of its companies (including small and medium enterprises) and industries. However, as the business environment within which the firms operate determines this sophistication, the focus must be on improving the quality of the region's business environment.

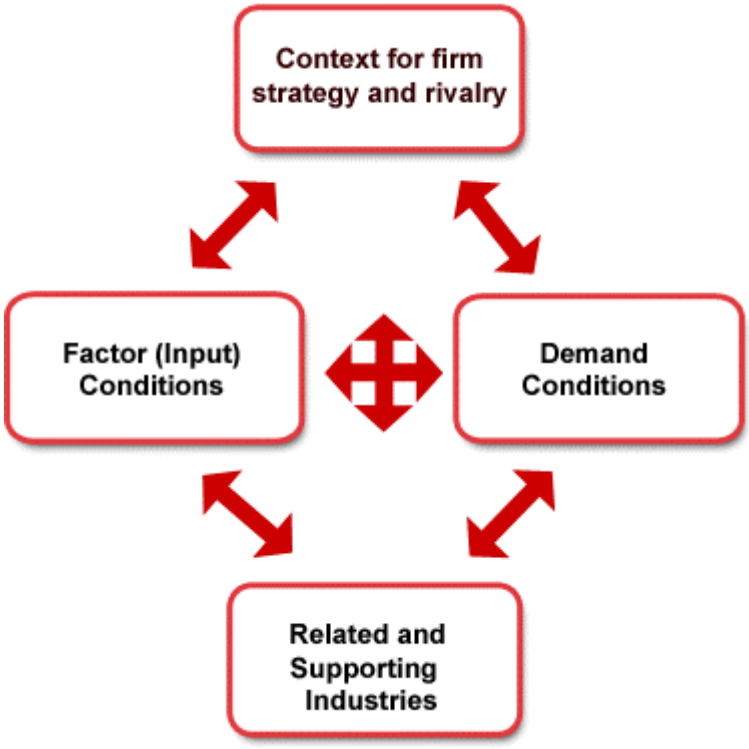
The quality of the region's business environment is embodied in four broad attributes that affect both productivity and the capacity to innovative on a sustainable basis. Prof. Michael E. Porter created the "diamond" in order to analytically present these four attributes.

The Diamond Approach

The four points of the diamond represent the four basic attributes that affect regional productivity and innovation. Each of the four attributes is self-reinforcing, has a unique and important role to play in the region's business environment and they all operate together as a

system. These four attributes are: environment or context in which firms build their strategies and compete; what are the factor (input) conditions in which firms operate; what are demand conditions in which firms operate; what are related and supporting industries that firms collaborate with.

The links among the four attributes of the diamond are presented below.



The diamond is unique to each cluster as its structure is affected by the regional business environment, that is the regional configuration of factors and the strategy/attitude that each region exhibits towards competitiveness in today’s global economy.

Advantages of Clusters

Clusters improve competitiveness (which results in improved productivity) in three ways;

1. Improve productivity through improved access to specialized suppliers, skills, and knowledge.
2. Innovation is more sustainable and given more importance as the need for improvement in processes of production is highlighted. And firms working together in the cluster can satisfy this need much better that otherwise the case would be.
3. Once established, clusters will grow as a result of the creation of new firms and the entrance of new suppliers (incubation effect).

Reasons for the growing importance of clusters and the cluster method of development

- The growing number of people involved in economic development activities. The decentralization of decision-making processes to the regional, city, and local levels and the renewed importance of international organizations have left many new policy planners with the need to find new tools to define their policies.
- The use of increasingly frustrating traditional industrial policies such as providing subsidies for uncompetitive industries (e.g. agriculture in the EU), attempting to build new industries from scratch and from above, and trying to attract incompatible (enclave-like) foreign investments are unproductive.
- The globalization of markets. With the reduction in the number of barriers to trade (e.g. WTO processes in Cancun, Doha), producers can compete freely globally, esp. under the conditions of the global knowledge economy. Given this, regions realize that they must compete globally in the industries in which they enjoy a competitive advantage. Globalization is thus leading to a specialization of regional economies. Clusters support this trend by building on local differences, seeking endogenous

growth sources of regional economies, reinforcing the assets already present in the local economies, etc, and so fostering the bottom up approaches to development, as opposed to top down approaches.

Recapitulation:

The cluster method fosters high levels of productivity and innovation and lays out the implications for competitive strategy and economic policy. Economic geography in an era of global competition poses a paradox. In theory, location should no longer be a source of competitive advantage. Open global markets, rapid transportation, and high-speed communications should allow any company to source any thing from any place at any time. But in practice, location remains important to competition. The global economic map is characterized by what Prof. Porter calls clusters: critical masses in one place of linked industries and institutions - from suppliers to universities to government agencies - that enjoy unusual competitive success in a particular field or fields. Porter explains how clusters affect competition in three broad ways: first, by increasing the productivity of companies based in the area; second, by driving the direction and pace of innovation; and third, by stimulating the formation of new businesses within the cluster. Geographic, cultural, and institutional proximity provides companies with special access, closer relationships, better information, powerful incentives, and other advantages that are difficult to tap from a distance. The more complex, knowledge-based, and dynamic the global economy becomes, the more this is true. Competitive advantage lies increasingly in local things - knowledge, relationships, and motivation - that distant rivals cannot replicate very efficiently. This is the essence of thinking globally but acting locally.

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Empirical test of the existence of dynamic changes in regional firm founding activities

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Abstract

Firm foundings are an important factor for regional development. A lot of valuable empirical research was already conducted to figure out which factors influence regional founding activities. In this paper the focus is slightly different because changing patterns of firm founding activities are the units of investigation and will be identified. Thus, the aim of the analysis is to find out if short- to medium-term changes in the regional firm founding activity do exist and how they look like. Such an approach can serve as an input for future research in which the relevant factors that lead to theses changes shall be detected.

Keywords. Entrepreneurship, Region, Case Study

JEL. R1, D21, C2

1. Introduction

Firm foundings have a strong impact on regional development: they positively influence the regional employment situation, the innovation activities and via cooperation and buyer-supplier-relations the whole regional innovation system (e.g. Klomp and Thurik 1999, Brenner 2001, Fornahl and Frenzel 2003, Hendry et al. 2000). This paper focuses on the

uneven regional distribution of start-up activities that can be observed in many empirical studies (e.g. Fritsch and Niese 1999, Bade and Nerlinger 2000, Berger and Nerlinger 1997). The central questions in this field of research are which factors influence the decision to start a firm and which resulting (local) founding dynamics can be observed? A lot of empirical studies already tried to answer the first question and identified relevant variables (e.g. Audretsch and Fritsch 1994, Reynolds 1994, Steil 1997, Nerlinger 1998) that can be grouped into main categories like 'industrial', 'national' and 'regional'. Industrial factors include all the aspects that are linked to the industrial characteristics of the observed industry like the market environment or the used technologies. National factors represent all the general factors that influence the founding activities irrespective of the industry and the region. Regional factors could be the regional infrastructure, the educational system, etc. In the majority of studies a static environmental context is assumed and a possible change of the environmental circumstances is neglected. Furthermore, short-term changes in the firm founding activities as well as switches of the founding activity from one level of activity to another (higher or lower) one are not considered. To sum up, in most studies the independent factors are given to varying degrees or not given at all and the effect on the corresponding founding rate as the dependent variable is analysed. In this paper the focus is slightly different because especially changes of firm founding activities over time are the units of investigation and shall be examined. Thus, the aim of the analysis is to find out if short- to medium-term changes in the regional firm founding activity do exist and how they look like. With such an approach this paper is complementary to the already existing empirical studies. Since the paper is partly conceptual in nature and proposing a framework and method that can be used for further empirical research, already existing empirical studies and especially the empirical data of these studies can be applied to this method.

The paper proceeds as follows. In section 2 the data source and the sample on which the empirical analysis is based is described. After that it is tested by using empirical data on firm

founding activity from 49 German regions in which regions, sectors and years these short-term shifts or start-up bubbles appear or whether the regional activities can be explained by industrial and long-term regional factors alone and which characteristics these changes have (section 3). Section 4 concludes and gives an outlook for further research.

2. Background of the Empirical Study

The empirical analysis focuses on two main areas: First, do short- to medium-term changes in the regional firm founding activities occur? In order to explore this question a method is proposed in section 3.1 that eliminates developments caused by industrial, national or long-term regional influences. Second, how do these developments in the firm founding activity look like? This question is answered exemplary by using empirical data on firm founding activity from 49 German regions (section 3.1). In this section the data source and the sample are described before.

In Germany only few databases are available in which the number of foundings is collected in a differentiated and credible way. It is especially difficult to get disaggregated data on a regional and industrial level. Possible sources for such data are for example the Centre for European Research (ZEW), the National Office of Statistic or a recent project trying to build up a "Regional Founding Atlas" (Fritsch et al. 2002, Fritsch and Niese 2000 or anonymous 2003). The sample, which is used in the following analysis, is based on the "Mannheim Founding Panels" of the ZEW.

The basis for the ZEW Founding Panel is the firm data provided by "Creditreform". Creditreform is the largest German commercial credit rating agency, thus, normally providing information regarding a firm's financial situation but also selling addresses and additional information to customers.

Although, there exist some shortcomings and disadvantages linked to the ZEW Founding Panel data, the data seems reasonable good to be used in this analysis. It is not possible to

give an accurate approximation of the absolute number of foundings in each industry, but there seems to be no systematic temporal and regional biases in the data. Fritsch et al. come to the conclusion that two data sources are most suitable in order to analyze founding activities (Fritsch et al. 2002). These are the ZEW Founding Panels and the employee statistics from the Federal Employment Office. Since the latter also includes branches in its database, one can conclude from analysis by Frisch et al. that only the ZEW Founding Panels can be used for the aim at hand.

The ZEW offers data on founding intensities (absolute number of firm foundings per 10.000 inhabitants between 18 and 65 years) for external users.[5] This data is available on the local administrative unit of a "Kreis" for Germany and Austria or aggregates of this unit like counties. The industrial differentiation is on the WZ-93 classification 2-digit level. This availability of founding data on a disaggregated level makes it possible to analyze time patterns of founding activities for different kinds of regional and industrial aggregates.

For the empirical analysis a sample is chosen that encompasses 49 regions, 15 sectors and 12 years. In this section this sample will be described and motivated.

The data used in the following ranges from 1990 to 2001. Especially for Eastern Germany only observations from 1990 onwards are possible because the data is not available for the time before and the comparability of the data before and after the re-unification would cause severe methodological problems. Additionally, on the one hand such a time span should be long enough to decrease the likelihood that singular short-term events bias the data. On the other hand, the time span is short enough that some regional factors can be regarded as fixed which is relevant for section 3.1.

[5] Since the ZEW based its calculation for the relative founding intensities for the years 2000 and 2001 on data on inhabitants from the year 1999, the relative founding intensities for these years were calculated by the author based on the absolute number of firm foundings provided by the ZEW and on the data of inhabitants taken from "Statistik Regional", a data source provided by the German Federal Office of Statistics.

As the geographic unit the level of so called "Kreise" is chosen. On this level 440 administrative units exist in Germany, thus, the data is collected and the analysis is conducted on a disaggregated level. The advantage of this level is that small developments in the founding activities can be observed that could not be seen in larger aggregates because of the leveling out of these developments by a larger basis. A disadvantage is that developments in the neighboring local units and influences from these units are not taken into consideration. Since such a neighboring effect shall not be analyzed in this paper, it seems more suitable to rely on very detailed information on the 'Kreis' level. From the 440 local administrative units in Germany not all were included in the analysis. Instead 49 regions were selected which are shown in Table 5 in the Appendix. These 49 regions were selected because they all included at least one firm that was listed in the NEMAX 50 ('New Market Stock-Index' of the German stock exchange containing the 50 most liquid stock values of the German New Market) or its successor the TecDax (Technology index containing the top 30 technology stocks traded in the Prime Standard segment of the German stock exchange in terms of turnover and market capitalization).[6] Thus, all NEMAX and TecDax firms were or are still concentrated in these 49 local units. This criterion was used for two reasons: first, the existence of a NEMAX or TecDax firm is assumed to influence the regional founding activities (which is relevant for a research presented in a different paper). Second, although the number of regions is relatively high and they show a large variety in various factors (see Appendix 5), it was supposed that these regions have a high number of firm foundings which makes them more interesting for economic analysis in general and which makes it possible to better analyze the development of the firm founding activity in particular.

[6] On the 1st of July 2003 a list of firms was compiled which had been or were still listed in one of these indices. As a next step the regions in which these firms were founded were collected.

15 industries were selected for the empirical analysis. A list of these industries can be found in Table 4 in the Appendix. The industries were selected according to the German classification of Economic Activities, Edition 1993 (WZ-93[7]) on a 2-digit level that is equivalent to the European NACE (Statistical Classification of Economic Activities in the European Community) 2 level. 12 of the industries belong to the manufacturing industry (No. 22 to 33). This is around 50 percent of all the industries in the manufacturing sector. The other three (No. 72-74) belong to the business service sector that is probably the most important one for other firms and thus for the upcoming analysis.

The 15 industries have a share of 28 percent of the total 2-digit industries. The WZ-93 level was chosen because a more aggregated one would just consist of a few industries that would make it impossible to analyze the individual processes in different industries. A more disaggregated level is not available at the moment but would be favorable in order to get more detailed information about the processes going on in the industries inside each 2-digit industry.

The 15 sectors were selected for various reasons: first, in these industries a high number of firm foundings are expected (especially in comparison to the agricultural or mining sector). Second, these sectors are expected to have a strong impact on regional development and regional innovation systems. Since the two sub-categories "Asset management" and "Management activities of holding companies" in the industry "Other business activities" are not directly related to innovation activities and have only an indirect impact on the development of other firms, these were left out in the analysis. Thus, they are not included in sector 74 (“Other business activities”).

[7] The WZ93 classification is the official German classification of industries.

3. Empirical Analysis of Changes in Regional Firm Founding Activities

After the description above giving an overview of the sample and explaining why this sample is used, the following sections will concentrate on the empirical identification of short- to medium-term changes in regional firm founding activities (section 3.1) and on the characterisation of these changes and on a classification (section 3.2).

3.1 Identification of changes in Founding Activities

Up to now it was only assumed that short- to medium-term changes in the regional firm founding activities do occur. In this section the question of whether such changes can really be observed in reality is answered. In order to address this question first a definition of short- to medium-term changes in firm founding activity has to be made. Let us assume that there are only four broad categories of factors influencing the regional firm founding activities. Namely these are the national and temporal (1), industry (2), long-term regional (3) and short- to medium-term regional (4) influences. The category 1 includes all the factors that influence all regions and all industries like national legislation, taxes and firm founding support. A dynamic aspect is contained in this category since the factors in this category and the firm founding activities do not have to stay constant over time but can both change. The second category takes into account that the characteristics of the industries vary largely and that this has an influence on the number of firm foundings. Thus, in each point in time the firm founding activity is likely to differ according to the industry. A combination of category 1 and category 2 would lead, in the simplest version, not to one aggregated curve (like for category 1 alone) but to disaggregated developments for each industry. Category 3 adds long-term regional influences to this picture. Not all regions will have the same regional environment and thus it is not likely that the firm founding activities in an industry are the same for all regions. Taken the first three categories together, the already disaggregated curves for each industry would shift up- or downward according to the regional advantages or disadvantages

of the regions under consideration. If only these three factors influence the regional founding activities, the founding intensity for one region in one sector for the period of time under consideration can be transferred into the aggregated curve of this sector by multiplying it with one fixed factor. If such a multiplier cannot be found it is likely that the fourth category has an impact on the firm founding intensities which leads to an corresponding shift in the founding activities and thus to short- to medium-term changes in these regional founding activities.

Thus, the definition of short- to medium-term changes reads as follows: A short- to medium-term change in the founding activity in one region and a specific sector occurs, if the regional development cannot be transferred into the aggregated one by multiplying it with a fixed multiplying factor for the period of time under consideration. In the following we are searching for time series for which this definition holds.

The regional firm founding activities are defined in terms of the likelihood that a person founds a firm in a specific sector, year and region. If this likelihood cannot be explained by the above describe procedure, a relevant time series is identified. Since only the observed firm founding activities can be derived from the data, the corresponding probabilities that can lead to this observation have to be calculated.

Thus, in order to test the hypothesis whether such a change in the likelihood of firm foundings takes place first the probabilities leading to the observed firm foundings are calculated. The calculation of the corresponding probabilities and the testing procedure is described in the following. Let us denote the regions with $r \in R = \{1,...,49\}$ with ordering the regions from 1 to 49 according to the code numbers in increasing order (see Table 5 in the Appendix). Let us denote the industries with $i \in I = \{1,...,19\}$. The industries are ordered from 1 to 15 according to the industry codes in increasing order (see Table 4 in the Appendix).

Furthermore, aggregates are constructed: aggr15 (i=16) corresponds to the firm founding activities of all 15 aggregated industries, aggr14 (i=17) to the aggregated industries without industry 74 ('Other business activities'), prod (i=18) contains the industries 22 to 33 (all the manufacturing industries) and service (i=19) holds the industries 72 to 74 (all the service industries). The time is denoted by $t \in T = \{1,...,12\}$ from 1990 to 2001. The calculation of the probabilities is done by using a binomial distribution with the two alternative events: 'founder' and 'non-founder'. For each year t, region r and industry i the observed number of firm foundings (equivalent to the number of founders) is given by $f_{i,r,t}$ and is directly taken from the data provided by the ZEW. The inhabitants of the region between 18 and 65 years of age are regarded as the population $n_{r,t}$. It is assumed here that all these inhabitants have the same probability of becoming a founder. The event 'founder' in a region r and industry i at time t occurs with the probability $p_{i,r,t}$. At each given confidence interval there exist two probabilities ($\overline{p}_{i,r,t}$ and $\underline{p}_{i,r,t}$) that can lead to the observed number of observations ($f_{i,r,t}$). Thus, we identify an interval in which the firm founding probabilities should be located in for a specific confidence interval. An example is given in (1) and (2) for a 95% interval (see e.g. Hartung, Elpelt and Klösener 1998).

$$\sum_{f\,=\,f_{i,r,t}}^{\infty} \binom{n_{r,t}}{f} \cdot \overline{p}_{i,r,t}^{\,f} \cdot (1-\overline{p}_{i,r,t})^{(n_{r,t}-f)} = 0.05 \qquad (1)$$

$$\sum_{0}^{f\,=\,f_{i,r,t}} \binom{n_{r,t}}{f_{i,r,t}} \cdot \underline{p}_{i,r,t}^{\,f} \cdot (1-\underline{p}_{i,r,t})^{(n_{r,t}-f)} = 0.95 \qquad (2)$$

$\overline{p}_{i,r,t}$ and $\underline{p}_{i,r,t}$ are then calculated numerically by using 95% and 99% confidence intervals. The results are 11172 intervals (49 regions times 12 years times 19 industries) in which the

probabilities must be located and which would lead to the corresponding observed firm foundings ($f_{i,r,t}$). The same is done for the aggregated level. Here the aggregated population of the regions at time t is defined as $N_t = \sum_r n_{r,t}$ and the number of firm foundings as $F_{i,t} = \sum_r f_{i,r,t}$. The borders ($\overline{P}_{i,t}$ and $\underline{P}_{i,t}$) of the interval are calculated by using (3) and (4):

$$\sum_{F=F_{i,t}}^{\infty} \binom{N_t}{F_{i,t}} \cdot \overline{P}_{i,t}^{F} \cdot (1-\overline{P}_{i,t})^{(N_t - F)} = 0.05 \tag{3}$$

$$\sum_{0}^{F=F_{i,t}} \binom{N_t}{F_{i,t}} \cdot \underline{P}_{i,t}^{F} \cdot (1-\underline{P}_{i,t})^{(N_t - F)} = 0.95 \tag{4}$$

The results are 228 intervals in which the probabilities must be located and which would lead to the corresponding observed firm foundings ($F_{i,t}$).

Based on these calculations it can be analysed whether the development over the whole time span in a region r in an industry i can be transformed into the aggregate development by multiplying the regional development with a fixed factor. Since both the regional probabilities ($\overline{p}_{i,r,t}$ and $\underline{p}_{i,r,t}$) and the aggregated probabilities ($\overline{P}_{i,t}$ and $\underline{P}_{i,t}$) are given as intervals, also the factors for the multiplication can range from a lower border ($\underline{m}_{i,r,t}$) to an upper one ($\overline{m}_{i,r,t}$). The borders of the intervals are calculated as follows ((5) and (6)):

$$\underline{m}_{i,r,t} = \frac{\overline{P}_{i,t}}{\underline{p}_{i,r,t}} \tag{5}$$

$$\overline{m}_{i,r,t} = \frac{\underline{P}_{i,t}}{\underline{p}_{i,r,t}} \qquad (6)$$

For each of the 931 time series (49 regions times 19 industries) that have to be analysed, 12 intervals result (one for each time t) by which the regional time series can be transformed into the aggregated one. Whether the whole regional time series can be transformed into the aggregated one depends on the existence of an overlap of all of the 12 intervals defined by $\underline{m}_{i,r,t}$ and $\overline{m}_{i,r,t}$. If such an overlap does not exist, such a transformation is not possible and thus, according to the definition above, a time series with a short- to medium-term change in regional firm founding activities is identified.

In table 6 to 8 in the Appendix the results of this procedure are presented. On the 95/95% level (both calculations for the probabilities ($\overline{p}_{i,r,t}$ and $\underline{p}_{i,r,t}$ as well as $\overline{P}_{i,t}$ and $\underline{P}_{i,t}$) were done on the 95% level) we find that 461 of the 931 time series (or around 50%) cannot be transformed in the aggregate one. Thus, these time series show a development in which the regional firm founding activities change during the time period under consideration. On the 99% level still 208 such time series can be found. Concerning differences between the industries one can conclude that there exist some industries in which these changes in firm founding activities occur more often than in others (Table 6). In general this phenomenon can be much more often observed in the service than in the manufacturing industry. A more detailed view shows that in some industry (all from the manufacturing industries) the phenomenon does not show up on the 99/99% level (industries no. 23, 25, 27, 31 and 32) or even on the 95/95% level (industry no. 23). Some industries in the manufacturing sector (like no. 22 'Publishing…'or 28 'Manufacture of fabricated metal products…') and the service sector (like no. 74 'other business activities' or no. 72 'Computer and related activities') display a stronger tendency towards these changes in founding activities. The same holds for the differences between the observed regions (Table 7). While some regions have no

(Warendorf, Offenbach and Rendsburg-Eckernförde) or only few (like Schwäbisch Hall, Minden, Cuxhaven or Aschaffenburg) of these changes, others like München, Karlsruhe, Hamburg, Berlin or Dresden show these changes in over 37% of the observed industries. Table 8 illustrates by a cross-tabulation how the changes are distributed over regions and industries. In this table it shows up that for 4 regions (Aschaffenburg, Cuxhaven, Minden and Walldeck-Frankenberg) the changes can only be found in the aggregated industries.

We can conclude from this such changes in regional firm founding activities can be found in the empirical data. Thus, the relative regional position in comparison to the aggregated firm foundings activities changes during the 12 years. These processes seem to be strongly influenced by regional circumstances (in 7 of the 49 regions no disaggregated changes or no changes at all could be found) and by the analysed industries with most of the findings in industry 74 and the aggregated industries.

3.2 Characteristics of Changes in Founding Activities

After the identification of the time series in which the changes took place, a deeper analysis is needed to get some additional insights. In the following some characteristics of these changes will be presented. In order to do this two different methods are used. The first one focuses only on the up and down development of the parameters $\underline{m}_{i,r,t}$ and $\overline{m}_{i,r,t}$ searching for the highest and lowest intervals. The second one assigns all 12 intervals of the parameters $\underline{m}_{i,r,t}$ and $\overline{m}_{i,r,t}$ to a specific level.

The first method takes one interval after the other and searches for significant differences between them. If $\underline{m}_{i,r,t}$ of an interval t is higher than $\overline{m}_{i,r,t}$ of an interval t – x (whereby x can

range from 1 to 11) then these two intervals are noted (as starting and ending point) and defined as an increase or positive change in the activities. If $\overline{m}_{i,r,t}$ of an interval t is lower than $\underline{m}_{i,r,t}$ of an interval t – x (whereby x can range from 1 to 11) these two intervals are defined as a decrease. If an increase was identified and $\overline{m}_{i,r,t}$ of the interval t+1 is higher than $\overline{m}_{i,r,t}$ of the interval t then the interval t+1 is the new ending point. The same holds if a decrease was identified and $\underline{m}_{i,r,t}$ of the interval t+1 is lower than $\underline{m}_{i,r,t}$ of the interval t. After such an increase or decrease was identified the reference point to which the following intervals are compared to is the ending point. The result of this method is a classification of the development over the observed 12 years in a succession of increases and decreases which are defined by the starting and ending points resulting from the highest and lowest values of the interval borders.

The results of this analysis are presented in Table 1. Around 68% of the time series show one change in their relative position in founding activities on the 99/99%-level. 26.4% change and change back again and only 5.3% show even a stronger up and down movement. Hence, in most cases in which the changes took place this appeared only one during the 12 years of observation or as can only be concluded from this kind of analysis the change in 68% of the cases only went in one direction (increase or decrease). A shortcoming of this kind of analysis is that the magnitude of increases and decreases cannot be identified. This problem can be solved with the second method described below. Before turning to the second method, the distribution of these findings according to the industries shall be briefly mentioned (Table 9 in the Appendix). Most turbulence (measured in the increases and decreases in the relative position) can be found in the aggregated and the service industries. In the manufacturing industries only no. 22 (‘Publishing…’) and no. 30 (‘Manufacture of office machinery and computers’) show one change in the direction of change (once increase-decrease and twice decrease-increase).

Table 1: Characterization of the identified developments

	Absolute Number Level[8]		Relative Number Level	
Kind of development	***99/99***	***95/95***	***99/99***	***95/95***
Increase	81	137	38.9%	29.7%
Decrease	61	110	29.3%	23.9%
Increase-Decrease	21	50	10.1%	10.8%
Decrease-Increase	34	106	16.3%	23.0%
Increase-Decrease-Increase	6	13	2.9%	2.8%
Decrease-Increase-Decrease	5	34	2.4%	7.4%
Increase-Decrease-Increase-Decrease		3		0.7%
Decrease-Increase-Decrease-Increase		6		1.3%
Increase-Decrease-Increase-Decrease-Increase		0		0.0%
Decrease-Increase-Decrease-Increase-Decrease		2		0.4%
Sum:	208	461		

The second method assigns each of the 12 intervals to specific levels. First it is identified how many levels do exist in each time series. In general a level is defined by the borders $\underline{m}_{i,r,t}$ and $\overline{m}_{i,r,t}$ of the 12 intervals. For each of the time series that are analysed at least two levels must exist because these time series were already selected in 4.1 based on the simplest criterion for a change of levels (the non-existence of an overlap). Here now more levels are defined. The first two levels are selected in the following way: Level 1 (the lowest level) is the interval with the lowest $\overline{m}_{i,r,t}$ and the level 2 is the interval with the highest $\underline{m}_{i,r,t}$. If all the other 10 intervals show an overlap with either the level 1 or with level 2 (defined by $\underline{m}_{i,r,t}$ and $\overline{m}_{i,r,t}$ of the corresponding interval) there exist only two levels. If not all the other intervals overlap, the intervals with the highest $\underline{m}_{i,r,t}$ (but whose $\overline{m}_{i,r,t}$ is lower than the $\underline{m}_{i,r,t}$ of the interval defining level 2) and the interval with the lowest $\overline{m}_{i,r,t}$ (but whose $\underline{m}_{i,r,t}$ is higher than the $\overline{m}_{i,r,t}$ of the interval defining level 1) are selected. If these two intervals overlap, level 2 becomes level 3 and the borders of the new level 2 are defined as the average $\underline{m}_{i,r,t}$ and

[8] 99/99 means that both the calculations of the probabilities on the regional ($\overline{p}_{i,r,t}$ and $\underline{p}_{i,r,t}$) and the aggregated level ($\overline{P}_{i,t}$ and $\underline{P}_{i,t}$) were done by using the 99% level. 95/95 represents the same for the 95% level.

$\overline{m}_{i,r,t}$ of all the intervals that overlap with these two intervals (but not with the intervals defining level 1 and level 3). If the two intervals do not overlap, the old level 2 becomes level 4 and the new level 2 is defined by the average $\underline{m}_{i,r,t}$ and $\overline{m}_{i,r,t}$ of all the intervals that overlap with the interval defined by the lowest $\overline{m}_{i,r,t}$ (but not with the intervals defining level 1, 3 and 4), whereas the new level 3 is defined by the average $\underline{m}_{i,r,t}$ and $\overline{m}_{i,r,t}$ of all the intervals that overlap with the interval defined by the highest $\underline{m}_{i,r,t}$ (but not with the intervals defining level 1, 2 and 4). If there still exist intervals that do not overlap with the levels 1, 2, 3 and 4, the procedure starts again. After this definition of the levels, all the 12 intervals are assigned to the levels. If the interval overlaps with the borders of only one level, this level is assigned to the interval. If the interval overlaps with two levels, the average of the two levels is assigned to the interval.

Table 2: Levels of changes

	99/99		***95/95***	
Highest Level	*Number*	*Share*	*Number*	*Share*
2	180	86.5%	380	82.4%
3	20	9.6%	63	13.7%
4	5	2.4%	13	2.8%
5	3	1.4%	2	0.4%
6	0	0.0%	3	0.7%
	208		461	

After the assignment was done, we can observe that in 86.5% of the cases there exist only two levels between the changes occur. But still 28 time series can be found in which the development crosses more than 2 levels. Note that even with only two levels there might be a lot of turbulence as it was defined above. To probe deeper in this question, the development across the levels is analysed.

A classification of the development across the levels seems to be helpful to answer the question of how the changes in the regional firm founding activities really look like. For this purpose a 5-year window is used that runs across each time series. A 5-year window was used because a smaller one appeared to be too small in order to capture all possible developments. A larger window largely increased the number of possible cases that might occur (81 cases for the 5 year window and 243 for the 6 year one) and this seemed to be a strong disadvantage for classification purposes.[9] The classification went as follows: in a 5-year window four changes of the level can take place. Possible changes might be staying on the same level, increasing or decreasing the level. For this case full as well as half steps up- and downward are regarded both as increases and decreases. Three alternatives times 4 possible possibilities for the change add up to 81 classes of development. It was counted how often each class appeared in the data.

Table 10 in the Appendix shows the result of this analysis. These 81 classes can be further condensed. A first brief re-grouping of the first 25 classes leads to 5 aggregated classes that are presented in the following table 3.

Table 3: Classes of changes according to the first 25 sub-classes

Class			***Observations***	
No.	***Definition***	***Sub-Class***	***Number***	***Share***
1	Staying the same	1	282	16.9%
2	Phenomenon at the edge of the window that cannot be clearly classified	2,3,4,8	328	19.7%

[9] Other problems like the interpretation of findings at the beginning and the end of the 12 year period are not discussed here but the author is aware of them.

3	Successive change of the level (up-down, down-up) which can be a statistical artefact	5,6,7,9,10,11	389	23.4%
4	New level defined as a change of the level as a successive stay on this new level	12,13,14,15	131	7.9%
5	Bump defined as a change to a new level for at least one year with a change back to the old level	18,20,22,23	77	4.6%

* Sub-classes No. 16, 17, 19, 21, 24 and 25 not assigned

The second and third class are of minor interest for the conducted research. From the other three classes some preliminary conclusions can be drawn. First, the high number of observations in which no changes occur, shows that there are many cases in which the level of firm founding activity stays the same for at least 5 years. Second, the founding activities change to a higher or lower level in many cases. The duration of this change differs and can last for 1 to 3 years at least (a longer period cannot be derived from the data) before falling back to the old level or even changing again. The other possible developments like a linear increase or decrease have to be further explored and new classes have to be built. Such a class formation will probably lead to 10 classes in which all the observations can be grouped.

4. Conclusions and Outlook

The aim of this paper was to develop a method by which changes in regional firm founding activity could be identified. Such identification seems to be possible with the proposed procedure. Furthermore, we were able to analysis the first characteristics of these changes and

in which sectors and industries they occurred. The last aspect that is preliminary in this paper it the classification of the founding development. Thus, in general the attempt seems fruitful for the analysis of firm foundings. After this brief description of the preliminary results, an outlook shall is given what will be the next steps: First, the already started classification procedure will be extended in order to include all the possible developments. Second, after the changes are identified the most it has to be figured out which factors let to this development. Two aspects are relevant in this respect: the general reasons for changes and the respective developments of the firm founding activities have to be collected from other empirical studies and theoretical considerations and afterwards this theoretical connection has to be tested by the empirically identified classes. Third, the derived theoretical link between factors and development has to be tested. Thus, the question is why the found changes have really occurred. This can be done by interviews or by a multivariate analysis taking the occurrence of a change (and the type of change) as the dependent and the possible underlying factors as the independent variable. Fourth, the tested method can be used to analyse other empirical data on firm foundings activities to which the results gained here can be compared.

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Appendix

Table 4: Selected characteristics of the industries included in the analysis

WZ93-Code	***Industry***	***Average absolute number of firm foundings per year and region***	***Average firm founding activity per 10,000 inhabitants***
22	Publishing, printing and reproduction of recorded media	19.79	0.58
23	Manufacture of coke, refined petroleum products and nuclear fuel	0.08	0.003
24	Manufacture of chemicals and chemical products	2.23	0.077
25	Manufacture of rubber and plastic products	1.76	0.079
26	Manufacture of other non-metallic mineral products	2.89	0.12
27	Manufacture of basic metals	1.60	0.062
28	Manufacture of fabricated metal products, except machinery and equipment	10.07	0.43
29	Manufacture of machinery and equipment	6.17	0.27
30	Manufacture of office machinery and computers	2.54	0.10
31	Manufacture of electrical machinery and apparatus	2.14	0.084
32	Manufacture of radio, television and communication equipment and apparatus	1.52	0.054
33	Manufacture of medical, precision and optical instruments, watches and clocks	6.66	0.26
72	Computer and related activities	68.00	2.08
73	Research and development	5.28	0.18
74	Other business activities / business services; without „Management activities of holding companies“ (74.15) and “Asset management” (74.847)	270.03	7.77

Source: ZEW Founding Panels; own calculations

Table 5: Selected characteristics of the sample regions

No.	*Name*	*Regional code*	*Av. no. of firm foundings per year (1990 to 2001)*	*Av. firm founding intensity per 10,000 inhabitants*	*Inhabitants (December 2000)*	*Inhabitants between 18 and 65 (December 2000)*	*No. of patents per inhabitant (patent averages 1995-2000; inhabitants 1998)*	*Geographical area in square km*	*Unemployment rate in 2001*	*Type of region in 1999*[1]
1	Lübeck	01003	538.2	38.37	213,399	135,958	152.65	214.14	13.8	2
2	Dithmarschen	01051	330.1	38.76	137,174	84,240	54.61	1,429.37	11.5	3
3	Rendsburg-Eckernförde	01058	734.3	42.88	270,119	172,280	133.67	2,185.49	8.6	2
4	Hamburg	02000	12107.8	105.24	1,715,392	1,149,508	154.97	755.33	9.6	1
5	Göttingen	03152	872	48.52	265,396	175,906	211.13	1,116.58	12.1	2
6	Cuxhaven	03352	268.1	20.96	204,843	126,935	45.77	2,072.50	10.6	2
7	Düsseldorf	05111	2971.6	76.04	569,364	380,779	299.57	217.00	10.4	1
8	Mühlheim/Ruhr	05117	541	47.16	172,862	108,597	299.14	91.29	9.4	1
9	Neuss	05162	1471.1	49.83	443,865	287,797	293.19	576.43	7.4	1
10	Aachen	05313	755.2	44.64	244,386	164,808	608.34	160.83	10.9	1
11	Köln	05315	3317.5	50.12	962,884	647,716	189.06	405.15	11.5	1
12	Heinsberg	05370	612.8	39.56	250,400	156,521	193.75	627.97	9.1	1
13	Warendorf	05570	574.8	32.74	280,443	175,133	233.28	1,317.05	7.5	2
14	Minden-Lübbecke	05770	726.8	36.70	322,789	196,548	200.05	1,152.06	8.7	1
15	Dortmund	05913	1521.7	38.77	588,994	377,617	118.40	280.29	14.7	1
16	Frankfurt am Main	06412	2911.1	64.38	646,550	446,402	244.99	248.31	7.7	1
17	Offenbach am Main	06413	448.8	56.87	117,535	78,199	217.71	44.90	10.3	1
18	Wiesbaden	06414	1212.5	67.92	270,109	177,575	232.90	203.90	8.4	1
19	Darmstadt-Dieburg	06432	859.3	45.49	286,780	189,661	637.45	658.51	5.9	1
20	Hochtaunuskreis (Bad Homburg)	06434	945.7	63.87	225,638	146,784	552.38	482.05	4.8	1
21	Main-Taunus (Hofheim)	06436	788.5	53.41	220,264	146,789	792.46	222.40	4.3	1
22	Wetterau-Kreis (Friedberg)	06440	949.3	50.55	294,260	189,800	270.71	1,100.70	6.5	1

[*] 1= agglomeration areas, 2 = urbanized areas, 3 = rural areas.

23	Lahn-Dill (Wetzlar)	06532	628.3	37.47	262,859	164,447	329.78	1,066.51	8.0	2
24	Marburg-Biedenkopf	06534	433.9	25.69	253,279	166,557	248.05	1,262.56	7.4	2
25	Waldeck-Frankenberg (Korbach)	06635	331.8	31.30	170,568	104,699	130.25	1,848.58	7.8	2
26	Westerwald-Kreis	07143	594	47.74	201,840	125,493	143.43	988.75	6.6	2
27	Kaiserslautern	07312	328.1	49.12	99,825	64,953	235.37	139.72	12.4	2
28	Mainz	07315	660	51.86	182,870	124,086	310.81	97.77	7.5	2
29	Stuttgart	08111	1853.8	45.76	583,874	396,645	569.90	207.36	6.6	1
30	Esslingen	08116	1293.9	38.97	500,666	326,194	663.18	641.44	4.2	1
31	Karlsruhe, Stadt	08212	989.2	52.73	278,558	185,160	339.35	173.46	7.9	1
32	Karlsruhe, Landkreis	08215	1121.2	41.43	419,555	270,429	370.76	1,084.96	5.2	1
33	Heidelberg	08221	393.7	39.93	140,259	98,685	535.43	108.83	6.6	1
34	Rhein-Neckar-Kreis (Heidelberg)	08226	1390.5	40.51	524,028	340,650	488.15	1,061.71	6.2	1
35	Breisgau-Hochschwarzwald	08315	613.3	40.44	240,545	152,735	266.01	1,378.34	5.3	2
36	Tübingen	08416	408.7	29.33	208,535	139,629	427.27	519.16	5.4	2
37	München	09162	5292.5	61.49	1,210,223	837,297	582.55	310.59	5.7	1
38	Freising	09178	573	58.53	152,307	102,230	524.74	799.61	3.5	1
39	München Land	09184	1709.5	86.46	295,247	200,921	989.54	667.27	4.0	1
40	Cham	09372	259.8	31.35	131,035	82,107	100.24	1,509.96	8.2	2
41	Nürnberg	09564	1553.5	46.84	488,400	321,926	287.88	186.37	11.0	1
42	Aschaffenburg, Stadt	09661	276.8	64.35	67,592	43,120	385.76	62.75	8.7	2
43	Augsburg	09761	718.3	42.33	254,982	163,884	259.46	146.72	8.2	2
44	Saarbrücken	10041	841.8	35.41	350,924	227,104	124.44	410.61	12.6	1
45	Schwäbisch Hall, Saarpfalz-Kreis	10045	363.1	35.17	157,309	99,868	177.79	418.55	8.0	2
46	Berlin	11000	13806.5	58.92	3,382,169	2,327,406	191.23	891.69	18.2	1
47	Dresden	14262	2160.9	69.68	477,807	318,509	308.53	328.30	15.9	1
48	Jena	16053	442.8	63.83	99,893	69,254	670.49	114.23	12.5	2
49	Sömmerda	16068	348.1	63.18	81,204	54,115	36.80	804.29	18.3	2

Partly based on: ZEW Founding Panels; 'Statistik Regional 2002' of the German Federal Office of Statistics; 'Patentatlas 2002'; INKAR 2000; own calculations

Table 4: Analysis of the industries in which short- to medium-term changes were identified

Industry Name	***Code***	Absolute Number ***Level***[12] ***99/99***	***95/95***	Relative Number[11] ***Level*** ***99/99***	***95/95***
Publishing, printing and reproduction of recoded media	22	7	34	14%	69%
Manufacture of coke, refined petroleum products and nuclear fuel	23	0	0	0%	0%
Manufacture of chemicals and chemical products	24	1	8	2%	16%
Manufacture of rubber and plastic products	25	0	5	0%	10%
Manufacture of other non-metallic mineral products	26	1	8	2%	16%
Manufacture of basic metals	27	0	7	0%	14%
Manufacture of fabricated metal products, except machinery and equipment	28	6	29	12%	59%
Manufacture of machinery and equipment	29	2	25	4%	51%
Manufacture of office machinery and computers	30	4	12	8%	24%
Manufacture of electrical machinery and apparatus	31	0	9	0%	18%
Manufacture of radio, television and communication equipment and apparatus	32	0	5	0%	10%
Manufacture of medical, precision and optical instruments, watches and clocks	33	2	24	4%	49%
Computer and related activities	72	24	42	49%	86%
Research and development	73	6	33	12%	67%
Other business activities	74	38	47	78%	96%
	aggr14	24	44	49%	90%
	aggr15	40	47	82%	96%
	service	36	48	73%	98%
	prod	17	34	35%	69%
		208	461		

[11] Relative number is calculated on the basis of 49 potential regions that might show the relevant behavior in this industry.

[12] 99/99 means that both the calculations of the probabilities on the regional ($\overline{p}_{i,r,t}$ and $\underline{p}_{i,r,t}$) and the aggregated level ($\overline{P}_{i,t}$ and $\underline{P}_{i,t}$) were done by using the 99% level. 95/95 represents the same for the 95% level.

Table 5: Analysis of the regions in which short- to medium-term changes were identified

Region		Absolute Number *Level*[14]		Relative number[13] *Level*	
Name	***Code***	***99/99***	***95/95***	***99/99***	***95/95***
Aachen	5313	5	12	26%	63%
Aschaffenburg	9661	1	7	5%	37%
Augsburg	9761	6	10	32%	53%
Berlin	11000	8	16	42%	84%
Breisgau-Hochschwarzwald	8315	6	10	32%	53%
Cham	9372	5	7	26%	37%
Cuxhaven	3352	1	5	5%	26%
Darmstadt-Dieburg	6432	3	9	16%	47%
Ditmarchen	1051	4	7	21%	37%
Dortmund	5913	4	9	21%	47%
Dresden	14262	9	12	47%	63%
Düsseldorf	5111	9	13	47%	68%
Esslingen	8116	3	11	16%	58%
Frankfurt	6412	6	13	32%	68%
Freising	9178	6	11	32%	58%
Göttingen	3152	6	8	32%	42%
Hamburg	2000	7	13	37%	68%
Heidelberg	8221	4	9	21%	47%
Heinsberg	5370	3	10	16%	53%
Hochtaunuskreis	6434	4	9	21%	47%
Jena	16053	6	10	32%	53%
Kaiserslautern	7312	5	8	26%	42%
Karlsruhe (Stadt)	8212	8	10	42%	53%
Karlsruhe	8215	2	8	11%	42%
Köln	5315	5	14	26%	74%
Lahn-Dill (Wetzlar)	6532	3	9	16%	47%
Lübeck	1003	4	5	21%	26%
Main-Taunus (Hofheim)	6436	6	7	32%	37%
Mainz	7315	5	9	26%	47%
Marburg	6534	3	9	16%	47%
Minden	5770	1	9	5%	47%
Mühlheim/Ruhr	5117	5	9	26%	47%
München	9162	8	15	42%	79%
München Land	9184	3	12	16%	63%
Neuss	5162	5	10	26%	53%
Nürnberg	9564	4	9	21%	47%
Offenbach	6413	0	6	0%	32%
Rendsburg-Eckernförde	1058	0	11	0%	58%
Rhein-Neckar-Kreis (Heidelberg)	8226	5	11	26%	58%
Saarkreis	10041	2	9	11%	47%
Schwäbisch Hall	10045	1	7	5%	37%
Sömmerda	16068	5	7	26%	37%
Stuttgart	8111	4	7	21%	37%
Tübingen	8416	5	10	26%	53%
Warendorf	5570	0	6	0%	32%
Walldeck-Frankenberg (Korbach)	6635	1	7	5%	37%
Westerwald-Kreis	7143	3	7	16%	37%
Wetterau-Kreis (Friedberg)	6440	4	10	21%	53%
Wiesbaden	6414	5	9	26%	47%
		208	461		

[13] Relative number is calculated on the basis of 19 potential industries that might show the relevant behavior in this region.

[14] 99/99 means that both the calculations of the probabilities on the regional ($\overline{p}_{i,r,t}$ and $\underline{p}_{i,r,t}$) and the aggregated level ($\overline{P}_{i,t}$ and $\underline{P}_{i,t}$) were done by using the 99% level. 95/95 represents the same for the 95% level.

Table 6: Cross-tabulation of the regions and industries changes were identified in (99/99% confidence interval)

	Industry																			Total
Region	22	23	24	25	26	27	28	29	30	31	32	33	72	73	74	aggr14	aggr15	prod	service	
Aachen									1						1	1	1	1		5
Aschaffenburg																	1			1
Augsburg	1												1		1	1	1		1	6
Berlin	1						1						1		1	1	1	1	1	8
Breisgau-Hochschwarzwald													1		1	1	1	1	1	6
Cham							1								1	1	1		1	5
Cuxhaven																		1		1
Darmstadt-Dieburg													1			1	1			3
Dithmarschen													1		1		1		1	4
Dortmund								1							1		1		1	4
Dresden	1						1						1	1	1	1	1	1	1	9
Düsseldorf	1				1							1	1	1	1	1	1		1	9
Esslingen															1		1		1	3
Frankfurt							1		1						1		1	1	1	6
Freising													1		1	1	1	1	1	6
Göttingen	1												1		1	1	1		1	6
Hamburg	1												1		1	1	1	1	1	7
Heidelberg															1	1	1		1	4
Heinsberg															1		1		1	3
Hochtaunuskreis													1		1		1		1	4
Jena													1		1	1	1	1	1	6
Kaiserslautern															1	1	1	1	1	5
Karlsruhe													1			1				2
Karlsruhe (Stadt)	1								1				1		1	1	1	1	1	8
Köln													1			1	1	1	1	5
Lahn-Dill (Wetzlar)															1		1		1	3
Lübeck							1								1		1		1	4
Main-Taunus (Hofheim)													1	1	1	1	1		1	6
Mainz														1	1	1	1		1	5
Marburg															1		1		1	3
Minden																			1	1
Mühlheim/Ruhr							1						1		1		1		1	5
München			1										1	1	1	1	1	1	1	8
München Land															1		1		1	3
Neuss												1	1		1		1		1	5
Nürnberg													1		1		1		1	4
Offenbach																				0
Rendsburg-Eckernförde																				0
Rhein-Neckar-Kreis (Heidelberg)													1		1	1	1	1		5
Saarkreis															1	1				2
Schwäbisch Hall													1							1
Sömmerda															1	1	1	1	1	5
Stuttgart													1		1		1		1	4
Tübingen								1						1	1		1	1		5
Walldeck-Frankenberg (Korbach)																1				1
Warendorf																				0
Westerwald-Kreis															1		1		1	3
Wetterau-Kreis (Friedberg)													1		1		1		1	4
Wiesbaden									1						1		1	1	1	5
Gesamt	7	0	1	0	1	0	6	2	4	0	0	2	24	6	38	24	40	17	36	208

Table 7: Number of changes according to industries

		99/99%-level[15] Absolute Number of changes			***95/95%-level Absolute Number of changes***					***99/99%-level Relative[16] Number of changes***			***95/95%-level Relative Number of changes***				
		1	***2***	***3***	***1***	***2***	***3***	***4***	***5***	***1***	***2***	***3***	***1***	***2***	***3***	***4***	***5***
Industry	22	5	2		19	13	2			4%	4%		8%	8%	4%		
	23																
	24	1			4	3	1			1%			2%	2%	2%		
	25				5								2%				
	26	1			5	2	1			1%			2%	1%	2%		
	27				5	2							2%	1%			
	28	6			19	9	1			4%			8%	6%	2%		
	29	2			21	2	2			1%			9%	1%	4%		
	30	3	1		10	2				2%	2%		4%	1%			
	31				8	1							3%	1%			
	32				5								2%				
	33	2			19	4	1			1%			8%	3%	2%		
	72	15	9		20	15	6		1	11%	16%		8%	10%	13%		50%
	73	5	1		25	7		1		4%	2%		10%	4%	0%	11%	
	74	24	12	2	17	21	5	3	1	17%	22%	18%	7%	13%	11%	33%	50%
	aggr14	17	5	2	22	14	7	1		12%	9%	18%	9%	9%	15%	11%	
	aggr15	28	9	3	14	22	10	1		20%	16%	27%	6%	14%	21%	11%	
	prod	13	4		17	13	4			9%	7%		7%	8%	9%		
	service	20	12	4	12	26	7	3		14%	22%	36%	5%	17%	15%	33%	
Sum		142	55	11	247	156	47	9	2	1	1	1	1	1	1	1	1

[15] 99/99 means that both the calculations of the probabilities on the regional ($\overline{p}_{i,r,t}$ and $\underline{p}_{i,r,t}$) and the aggregated level ($\overline{P}_{i,t}$ and $\underline{P}_{i,t}$) were done by using the 99% level. 95/95 represents the same for the 95% level.

[16] Relative number is calculated on the basis of the sum of the observations in each of the categories (142, 55, 11, 247 etc.).

Table 8: Classification of level changes

99/99			Change no.			
Class	***Number***	***Share***	***1***	***2***	***3***	***4***
1	282	16.9%	same	same	same	same
2	93	5.6%	same	same	same	decrease
3	91	5.5%	increase	same	same	same
4	79	4.7%	same	same	same	increase
5	78	4.7%	same	same	decrease	increase
6	78	4.7%	decrease	increase	same	same
7	74	4.4%	same	decrease	increase	same
8	65	3.9%	decrease	same	same	same
9	58	3.5%	same	same	increase	decrease
10	56	3.4%	increase	decrease	same	same
11	45	2.7%	same	increase	decrease	same
12	44	2.6%	same	same	increase	same
13	39	2.3%	same	increase	same	same
14	24	1.4%	same	same	decrease	same
15	24	1.4%	same	decrease	same	same
16	22	1.3%	increase	same	decrease	increase
17	21	1.3%	increase	decrease	increase	same
18	21	1.3%	same	increase	same	decrease
19	21	1.3%	decrease	increase	same	decrease
20	20	1.2%	decrease	same	increase	same
21	19	1.1%	increase	same	same	increase
22	18	1.1%	same	decrease	same	increase
23	18	1.1%	decrease	same	same	increase
24	17	1.0%	same	increase	decrease	increase
25	16	1.0%	same	decrease	increase	increase
26	15	0.9%	increase	same	increase	decrease
27	15	0.9%	same	decrease	increase	decrease
28	15	0.9%	decrease	increase	decrease	increase
29	15	0.9%	decrease	increase	decrease	same
30	14	0.8%	decrease	increase	same	increase
31	13	0.8%	increase	increase	decrease	same
32	13	0.8%	increase	same	decrease	same
33	12	0.7%	decrease	same	increase	decrease
34	12	0.7%	decrease	same	same	decrease
35	11	0.7%	increase	same	same	decrease
36	11	0.7%	increase	decrease	increase	decrease
37	11	0.7%	increase	decrease	same	increase
38	10	0.6%	same	increase	same	increase
39	10	0.6%	decrease	increase	increase	decrease

99/99			Change no.			
Rank	***Number***	***Share***	***1***	***2***	***3***	***4***
40	9	0.5%	same	increase	decrease	decrease
41	8	0.5%	increase	increase	same	same
42	8	0.5%	increase	increase	same	decrease
43	8	0.5%	decrease	decrease	increase	same
44	7	0.4%	same	same	increase	increase
45	6	0.4%	increase	same	increase	same
46	6	0.4%	increase	decrease	increase	increase
47	6	0.4%	increase	decrease	same	decrease
48	6	0.4%	increase	decrease	decrease	increase
49	6	0.4%	same	increase	increase	decrease
50	6	0.4%	decrease	increase	increase	increase
51	6	0.4%	decrease	increase	increase	same
52	5	0.3%	increase	increase	increase	same
53	5	0.3%	increase	same	decrease	decrease
54	5	0.3%	decrease	same	decrease	increase
55	4	0.2%	increase	increase	increase	decrease
56	4	0.2%	increase	increase	decrease	increase
57	4	0.2%	increase	same	increase	increase
58	4	0.2%	increase	decrease	decrease	same
59	4	0.2%	same	same	decrease	decrease
60	4	0.2%	same	decrease	same	decrease
61	4	0.2%	same	decrease	decrease	same
62	4	0.2%	same	decrease	decrease	decrease
63	4	0.2%	decrease	decrease	same	increase
64	4	0.2%	decrease	decrease	decrease	increase
65	3	0.2%	same	increase	increase	increase
66	3	0.2%	same	increase	increase	same
67	3	0.2%	same	decrease	decrease	increase
68	3	0.2%	decrease	same	decrease	same
69	3	0.2%	decrease	decrease	increase	decrease
70	2	0.1%	decrease	increase	decrease	decrease
71	2	0.1%	decrease	same	increase	increase
72	2	0.1%	decrease	decrease	decrease	decrease
73	1	0.1%	increase	increase	increase	increase
74	1	0.1%	increase	decrease	decrease	decrease
75	1	0.1%	decrease	same	decrease	decrease
76	1	0.1%	decrease	decrease	same	same
77	1	0.1%	decrease	decrease	same	decrease
78	1	0.1%	decrease	decrease	decrease	same
79	0	0.0%	increase	increase	same	increase
80	0	0.0%	increase	increase	decrease	decrease
81	0	0.0%	decrease	decrease	increase	increase

Internationalization – A critical factor of success for knowledge-based start-ups?

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1. CHARACTERISTICS AND IMPORTANCE OF KNOWLEDGE-BASED FIRMS

There is no single definition of knowledge-based firms. Although as the name implies, knowledge-based firms are those in which the development, possession and application of knowledge is central to the production of particular goods and services. They are characterized by a high dependence on the processing of knowledge for their competitive performance. Such dependence is often focused on individuals or small groups controlling specialist forms of expertise. It is manifested in distinctive forms of work organization – often project-oriented – and in idiosyncratic management practices. Scientist started ventures represent a special case of knowledge-based firms.

The focus of this article is on start-ups derived from research institutions and universities. Higher-education institutions are no longer only a source of qualified manpower for the job markets but are now sowing seeds for new enterprises. Engagement of universities with industry began with the objective of creating fit between the education and training imparted to the graduates and knowledge and skills required by industry. Then this evolved to transfer of technology and know how. Now it has matured to creation of new enterprises itself on the

strength of intellectual resources of universities. Integration of higher-education institutions with business enterprises resulting in the establishment of Science Parks, Technology Parks and Research Parks was started in the USA in 1950s. Subsequently, these initiatives gained acceptance the world over as these helped in the promotion and growth of new industrial structures, in generation of additional avenues of gainful employment and also as an additional source of income for universities.

Knowledge-based firms are increasingly common in the new economy. They play an important role for economic development and job creation in industrialized countries. As they possess high potential for sustainable growth they account for a disproportionately large part of gross jobs gained. Also, they provide a variety of innovations and technologies to cope with more turbulent global competition dynamics. According to a publication by the Advisory Council on Science and Technology in 1990, smaller firms with competitive advantages can grow very rapidly and diffuse their products into the economic structure, so raising the level of average practice economic performance in their sector. It is because of this connection between diffusion and average efficiency that barriers to growth for the individual firm become barriers to raising the national level of economic performance. (Acost, 1990) Especially the creation and "growing up" of companies started by university founders play a positive role in promoting rapid structural change in the national economy. (Kirchhoff, 1994; Etzkowitz, Webster and Healey, 1998)

Because of their importance, knowledge-based firms have received increasingly attention from economists and policy makers within the last decades. Around the globe several programs had been designed to support entrepreneurs from universities and research institutes aiming in the creation of successful firms.

The article focuses on success factors of new knowledge-based firms. Hereby the emphasis is on internationalization activities and their impact on the development of the firm.

Several studies indicate that knowledge-based corporations often act across national borders and perceive the world market as their relevant market. (Bürgel 2000; Oviatt and McDougall 1994) Many of them are exporters, often competing in the international marketplace from their earliest days. Thus, internationalization seems to have an enormous importance for young firms in knowledge intensive industries. However, investigations on how internationalization is influencing the performance of the firm are rarely. There is no comprehensive theory that explains why knowledge-based firms in favor are going abroad.

The article is addressed to entrepreneurs and managers from companies originated by universities as well as policy makers and promoters of knowledge-based firms. The objective is to raise the awareness for the importance of international activities but also to discuss the conditions for success of internationalization.

Section two of this article gives a definition of success. What does it mean for a knowledge-based firm to be successful? This review is necessary as there might be different understandings of success: While politicians are interested in firms that contribute to economic development, innovative entrepreneurs might strive for realization of short-term profits or self-realization through implementation of their research results.

Innovative start-ups pose unique problems and challenges, and most of them fail and never grow. Success demands more than a good product; it requires the right combination of partners, employers and investors, and a suitable environment. Section three examines the factors that influence the success of knowledge-based firms. Entrepreneurship literature already provides different approaches and concepts for success factors of start-ups in general. The authors derive critical factors that affect the development of innovative start-ups.

In section four the authors concentrate on internationalization as one factor of success. It is discussed whether and why internationalization might play an important role for knowledge-based start-ups to overcome obstacles.

Based on the insights discussed in the previous sections finally the conditions are illustrated for that case that internationalization represents a critical success factor.

2. INDICATORS FOR SUCCESS OF KNOWLEDGE-BASED FIRMS

The definition of business success is quite differently for each business and by each individual. Business success is subject to individual interpretation based on upbringing, past experiences, role models, competitive forces, personal motivations and goals. For some, merely staying in business can be considered success, while for others it could be achieving a certain level of sales or profit. Applying this to knowledge-based start-ups, firms are successful in the eyes of politicians and economists when they create jobs and economic wealth. The founders itself may strive for self-realization, the competition of their research and implementation, the realization of profits, and so on.

Most people who achieve business success first defined it, then planned for it, and pursued it diligently; they set goals to achieve it. Figure 1 gives an overview of possible individual objectives for the success of a knowledge-based firm which is not complete yet.

See FIGURE 1.

The view of business success will change at various times throughout business cycles and the founder's career. For example, what might be deemed successful early in start-ups stage might be viewed very different as the company has grown and become big.

As an innovative entrepreneur achieves success in business, it is sometimes measurable and sometimes not. Accumulating a certain volume in sales is certainly one way to measure success, but it is not the only way; earning a prestigious award, earning the respect of peers, or providing livelihood to employees may be far more meaningful to some founders. In figure 2 some measures of business success and their conjunction are presented.

See FIGURE 2.

Concluding, there are different understandings of business success as well as measures. To answer the question what factors are important for knowledge based firms first one have to find a definition of business success for those kind of firms. Without taking into consideration different plans and goals of founders it is not possible to find out whether and under which conditions internationalization will lead to the success of the firm.

As this article points out the importance of knowledge-based firms to regional development, the authors suggest the following definition for use in the paper:

A knowledge-based firm can be regarded as successful if

(1) the technology or knowledge it based on is fully developed and the product or service already have been bringing onto the market, and

(2) the numbers of sales and employees had been growing over a certain period of time or if they are still growing.

According this definition success is declared as growth resulting in the creation of jobs. Applying that to the initial problem, the central question is now: Does internationalization leads to growth? The following section comprises a review on literature to identify obstacles

that hamper growth and to specify factors that influence the success of knowledge based firms.

3. SUCCESS FACTORS OF KNOWLEDGE-BASED FIRMS

New knowledge-based firms pose high potential for sustainable development and growth. Their novel technological solutions promise competitive advantages and high profits. (Baier and Pleschak, 1996, p. 56) However, because of their special characteristics they face well above average business risks. The attainment, upgrade and sustainment of competitive advantages hardly depend on the abilities and efforts to overcome several restrictions and difficulties.

Economic Exploitation of New Knowledge

To succeed, a knowledge-based entrepreneur needs more than an innovative product. Success requires the right combination of partners, employees, and investors. Also, not the invention and development of a new technology is crucial but the protection of intellectual property and getting the product to market quickly. (Preston, 2003b, p. 24)

Once a technology had been developed the ability to exploit this knowledge and to take economic use of it are determining the company's success. Therefore it is important to consider **intellectual property protection** at the founding of a new company.

Knowledge as unique resource of a company accounts for competitive advantages. Unfortunately, knowledge is at least partly a public good. As knowledge may not remain unique for a long time, the firms rent-earning opportunity decimates. Hence, efforts are necessary to prevent any imitation of the innovation. Patents and copyrights are the first choice, but knowledge that has potential commercial value is often also protected with

secrecy. Another way to limit the expropriation of venture knowledge is to use **network governance structures**. Network structures of alliances with complementary organizations tend to control the risk of expropriation. (Oviatt and McDougall, 1994, p. 57)

Also the time at which the product **reaches the marketplace** may determine its success. However, there is a trade-off between speed and quality. When a company rushes a new product to the market that is defective it could be an expensive mistake.

New knowledge-based firms in technology industries need **sufficient demand** for their products. Because of high capital investments in the start-up stage, economies of scale could be favorable. However, the sales of large amounts of e.g. engine plants or specific technological solutions might be restricted because of small domestic markets and lacking local demand.

Once a product had been developed and launched **continued innovation activities** ensure technological leadership and the sustainment of competitive advantages. Thereby it might also important to cooperate with universities and research institutions. (Steinle / Schumann, 2003, p. 59)

Overcome Information Asymmetries

Innovative start-ups and their respective market partners are faced with severe asymmetric information problems due to their lack of prior production history and reputation. (Backes-Gellner / Werner, 2004)

As innovative start-ups market new products and services they possess no customer base. Moreover, the novelty and complexity of their products and services requires a special **customer orientation** and service. Thus, marketing and distribution activities are essential. Special efforts are inevitable to make customers familiar with the benefits of the new

technical solution offered. To a certain extent a special training, education or instruction is necessary, e.g. for technical plants.

Innovative start-ups also have no labor market history. This makes it difficult for potential employees when deciding whether to accept a job or not. However, to find and to **recruit qualified human resources** is important to new firms when growing. A wide range of human competence is required to commercialize, produce the merchandise and develop the business organization.

Knowledge-based firms are also complex and difficult for lenders and investors to understand and evaluate. Assets such as knowledge, process technologies, or patents tend to be characterized as "soft". These firms often lack the hard assets – buildings, equipment, and inventory – that lenders have traditionally accepted as collateral. Such firms therefore tend to be confronted by higher costs when seeking financing, or they may be denied financing altogether.

Moreover, many innovative growth companies, particularly those in emerging knowledge-based sectors, have difficulty finding venture investors with enough knowledge about their business to add value. **Attracting financing** will be a challenge to the entrepreneurial skills of small knowledge-based companies themselves. The technological and creative skills of entrepreneurs in knowledge-based businesses are frequently not matched by their management and general business skills. For lenders and investors, these managerial shortcomings increase the risk of deals that are already difficult to understand.

To find investors is important, as significant amounts of financial assets are needed to turn the firm and its merchandise from ideas into viable business opportunities.

Entrepreneurial Management of the Company

The development of a knowledge-based company is to a large extent influenced by the founder's attitudes and qualifications. One should never underestimate the role of passion, the importance of management talent, and the significance of teaming.

However, founders of firms derived from research institutions commonly lack previous business experiences, contacts and relations that must be seen as crucial for a potentially prospering young business. **Qualification** and background of the founder are crucial factors in turning a vision into business reality. The lack of knowledge in strategic management as well as and operative management are frequent causes for failing. (Pleschak, 2002, p. 85)

Teams of people with complementary skills perform better. "For example, if a technologist partner with someone who knows the capital markets and another person who knows how to market technology-based products, the team of three will have a much higher probability of success than the solitary technologist trying to start a company on his or her own." (Preston, 2003a, p 16.)

A survey among knowledge-based firms in three university regions of the Netherlands found that the effective combination of craftsmanship and entrepreneurship, knowledge of the market, and networking are seen by entrepreneurs as the determinants of their success. Moreover, the more innovative entrepreneurs rank **networking** higher than other entrepreneurs. (Poutsma, 1997)

Resuming, the success of new knowledge-based firms depends on several factors that can be described as

(1) the ability to capitalize the innovative product or service,

(2) the ability to overcome information asymmetries in order to obtain financial and human resources and to convince potential costumers from the benefits of the product offered, and

(3) the behavior and background of the founders.

Figure 3 gives an overview on these factors.

See FIGURE 3.

Besides, some authors also argue that **external support activities** provided by public or corporate business supporters can be of great help for the creation and development of new business ventures. (e.g. Tötterman, 2004)

For a much more deeper investigation of success factors for start-ups it should be taken into consideration that the role of certain factors differs according to the stage of the firms development and therefore a dynamic view is necessary.

4. INTERNATIONALISATION, PERFORMANCE AND SUCCESS FACTORS

The term internationalization is used to describe the process by which the firm increases their international activities. Transnational activities of firms range from exports through licensing, contracts, franchising to foreign direct investment. They represent alternative strategies to enter and serve foreign markets or to provide a firm with resources. They vary in respect to resource commitment, level of perceived business control and involved risks

Internationalization can be measured by numerous parameters like the number of employees working abroad, the number of foreign subsidiaries, the percentage of the firms employees working abroad, the profit or the percentage of profit gained abroad, etc.

Several studies state that internationalization of start-ups is particularly pertinent in high technology / knowledge-based industries, indicating that international business activities may have an enormous importance for that kind of firms. (Bürgel, 2000, p. 18) This view is also facilitated by the results of a diploma thesis at the University of Applied Sciences in Jena. Out of 71 interviewed German new technology-based firms 67,6% specified the international character of their business. (Reisberg, 2000, p. 118) Another more recent study of Thuringian high-technology start-ups found that out of 30 interviewed firms 15 start-ups already had served international markets, and 12 start-ups had plans to do so. (Beibst / Lautenschläger, 2002)

International activities are of critical strategic concern for firms in knowledge-based industries and, therefore, they should be a key area of attention when investors and entrepreneurs putting together a business plan. (Bürgel, 1998, p. 18)

On the one hand, the causes of international commitments can be found in the nature of the business itself. Several authors argue that the internationalization behavior of the firm is largely influenced by industry-specific factors. (McDougall, 1989; Bell, 1995; Boter and Holquist, 1998) Factors are for example: the need for special resources and inputs, limited domestic demand for a special technological solution, the intensity of domestic competition and so on. Certainly the most important reason is that small domestic markets do not offer enough opportunities for growth. Young firms increase their international presence because of the domestic pressure, because of the international pull, or because of distinct competitive advantages.

On the other hand, there are factors that are situated in the entrepreneur's person itself, such as knowledge and experiences, intentions, characteristics. The entrepreneur's background and his intra-personal skills are important when explaining international entrepreneurship. Several studies indicate that the founders' international experience facilitates internationalization processes and leads to a higher degree of internationalization of a firm. (Lindqvist, 1991; Bloodgood, Almeida and Sapienza, 1996; Reuber and Fischer, 1996) A case study on four high-technology start-up companies that grew extremely rapidly and built up international presence in several countries within few years reports that all founders had international backgrounds from education and previous work experience and a "vision" to turn their business into globally operating firms. (Jolly, Alahuhta and Jeannet, 1992)

A study of US and UK small international high-technology start-ups found four important factors to be particularly influential: (1) the international vision of the founder, (2) the recognition that a large proportion of the firm's prospective customers were foreign along with (3) the identification of specific international opportunities, and (4) the desire of the founder to be international market leaders. (Johnson, 2002)

Past research on the internationalization of small innovative start-ups has resulted in discovering and consolidating important knowledge about the role of internationalization for improved performance. Now scholars know a lot about the antecedents of the internationalization of the small firm. However, "…evidence on the effect of internationalization on small company's long term performance and survival is particularly fragmentary and contradictory."(Manolova / Manev, 2001) Several studies indicate that early-internationalized companies are not more successful than others per se. (Schmidt-Buchholz, 2001, p. 272)

5. CONCLUSION

In section 1 the question had been raised whether internationalization is a necessary action for knowledge-based firms to become successful or not. After defining success as the achievement of growth in sales and employment, it had been asked for the factors that are essential to overcome obstacles in the firm's development. A review of literature and research had shown that young knowledge-based firms could gain great advantages when they internationalize. However, the positive correlation between international activities and performance of the firm is not clear and empirical not confirmed.

Internationalization can help a knowledge-based start-up to overcome several obstacles. The table in figure 4 shows different goals of knowledge-based firms and constraints that must have overcome. In each case internationalization could be a possible step, that helps to succeed.

See FIGURE 4.

Concluding, internationalization is not a necessary condition for a young knowledge-based firm to survive and to grow. It is rather a strategy which

(1) depends to some extend on the founders abilities and objectives, and which

(2) serves to achieve growth or to supply the firm with resources that are not available in the domestic markets.

Further research in that field should be targeted to the development of a comprehensive model that explains under which conditions a young innovative firm will be more successful if it internationalizes than others that does not. This investigation also should include an empirical component.

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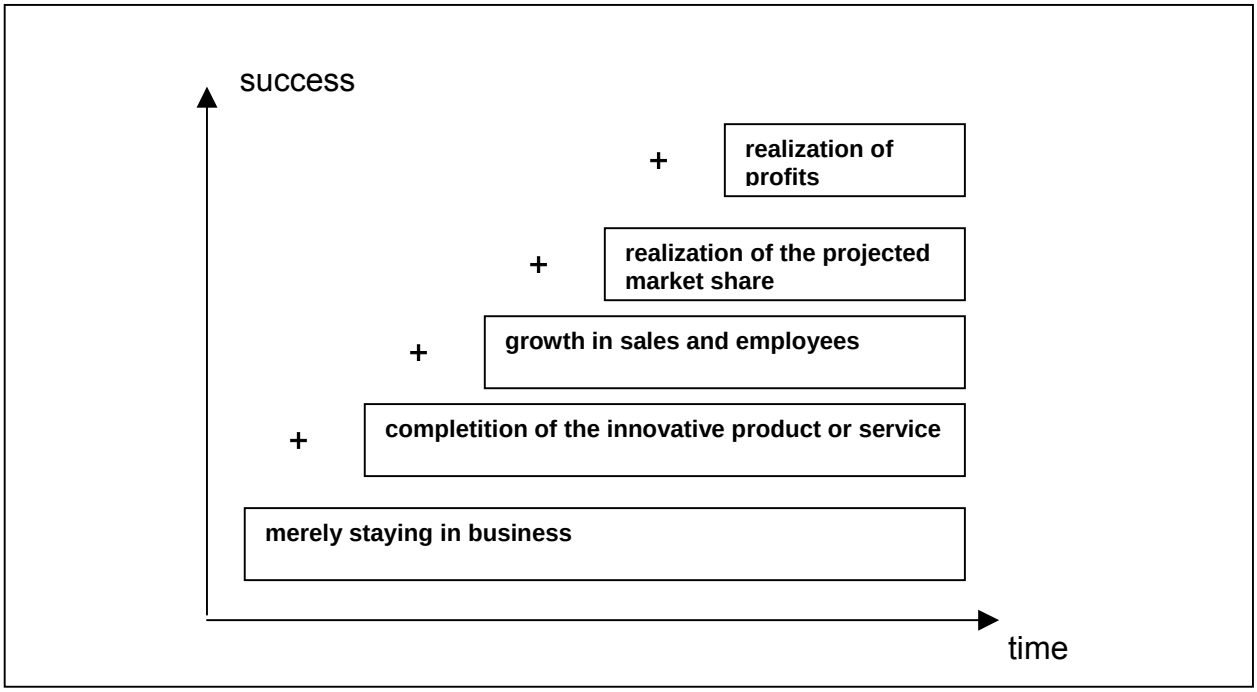
FIGURES

Fig. 1: Possible visions of success for knowledge-based ventures

the view of entrepreneurs					the view of investors	the view of universities		the view of politicians	
self realization	survival of the firm	implementation of research results into economic value	costumer satisfaction	realization of profits	return on investment	attainment of additional revenues	transfer of knowledge to industry	tax revenues	job creation / economic wealth

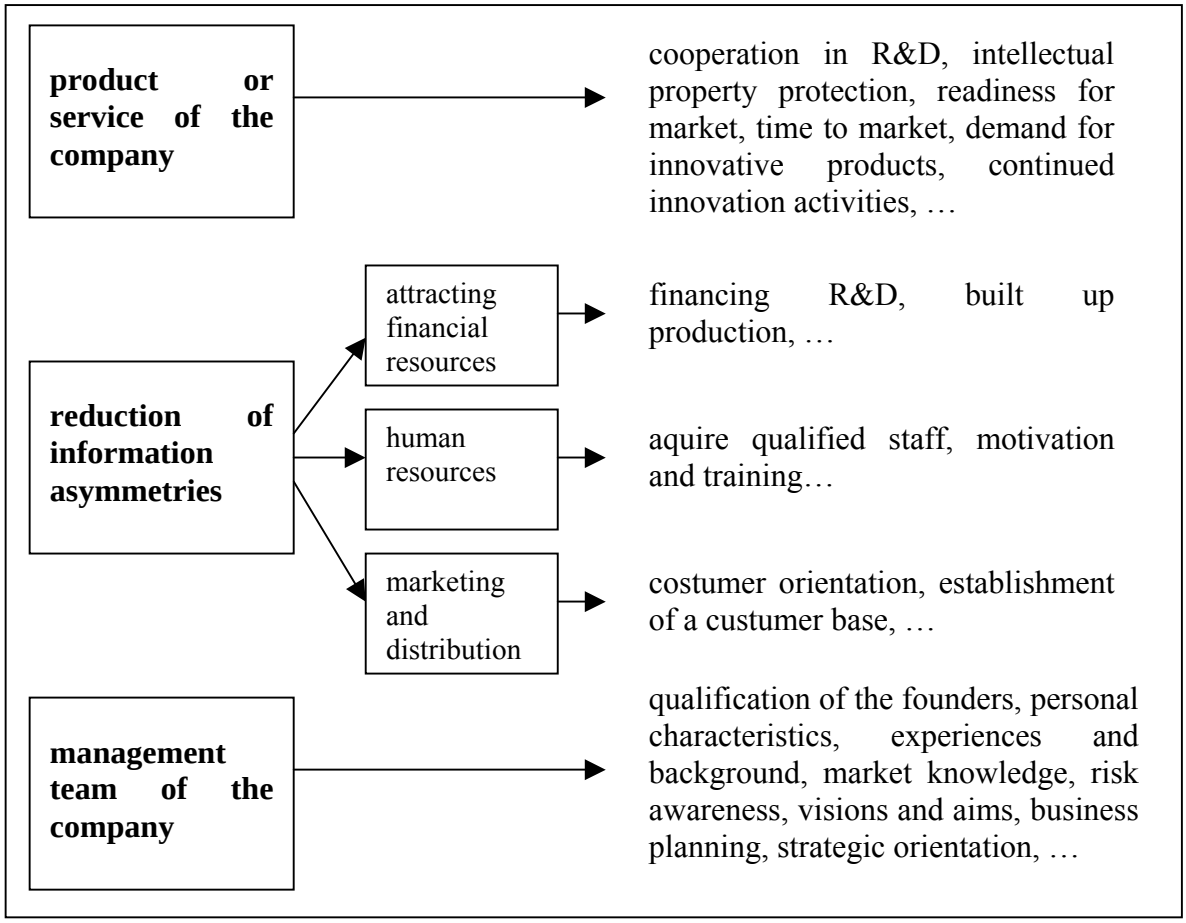
Source: own figure

Fig. 2: Additive assignment of success factors for technology-based start-ups



Source: Steinle / Schumann, 2003, p. 21.

Fig. 3: Success factors of new knowledge-based firms



Source: own figure

Fig. 4: Internationalization as success factor

OBJECTIVE	CONSTRAINT	ACTION
product development and continued innovation	absence of local research partners	cooperation in R&D with foreign partners
	local availability of suitable capital	attracting investors from abroad
intellectual property protection	global enforcement of property rights and lax property protection in some countries	governance network structures and alliances with foreign partners
set up of production facilities and purchasing equipment	local availability of suitable capital	attracting investors from abroad
	attracting qualified human capital	attracting foreign workforce, relocate production abroad
selling products and earning profits	limited domestic demand for a special technological product	export of products, establishments of foreign subsidiaries

Regional Economic Development Based on New Technologies: A Proposed Model

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Abstract

The objective of this paper is to discuss the role of the university in the regional economic development process. First, we seek for the changes that the university must embrace in order to be the key element in the economic development process. From there we learn the undergoing changes that are moving universities from producing ideas into producing goods, services and firms. Second, we look to the social advantage of using university infrastructure as a targeted policy for R&D investment. The result shows that the social rate of return to R&D investment through universities far exceeds the private one. Third, the outcomes of economic policies towards entrepreneurship behavior and R&D investment are used to explain high-tech exporting success. In general, our results support the idea that university infrastructure may be used in a targeted policy for R&D investment to achieve economic development through exporting high-tech goods.

I. Introduction

In economic development the most important aspect is to know precisely the sources of the innovations. This is equivalent of learning the engines of economic growth and development. In this paper we focus in one of the source of knowledge production, the

university. More precisely we are concerned with the appropriation of ideas developed in the universities into economic goods. So, ideas are "non-rival" goods, however their products are "rival" as in Romer (1996)'s words. In our view the undergoing revolution in the universities where goods and firms are becoming a very important output and not just ideas may be fostered by a R&D targeted policy.

This view is linked to the new endogenous growth theory that has demonstrated how important the development of new technologies in the long run growth process is.[17] For instance Romer (1990) has shown that the size of human capital force allocated to the R&D - research and development - sector of the economy is vital for economic growth. The size of of the human capital in the R&D sector depends upon policies and incentives for the development of endogenous technological products or services. There is also the need for adequate infrastructure. In this paper, we plan to discuss the importance of the university as the centerpiece for an economic regional development based on new technologies.

The major characteristics of a regional economic development model are the requirement of basic infrastructure and human capital. Both characteristics seem to be present in the universities. For basic infrastructure we mean laboratories and equipments that are used in the innovation process. By human capital we mean the scientists and researchers.

The most recent focus of economic research is the new role of the universities in the economy's innovation process. The universities are undergoing into a transformation process to become a new source of high-tech firms. In this new role, the university besides producing human capital, products, services, it will be also in charge of spinning-off new firms. This new product demands entrepreneurial knowledge, besides the scientific one. The commercialization process of new products, patents, services and firms by the universities has demanded changes in behavior and required new laws. We will look at the literature to learn

[17] See Aghion and Howitt (1998).

about the important elements that must be present in this new activity to be pursuit by the universities and its new role on economic development.

The success of this role by the university is very much linked to the rate of return to R&D investment. The discussions on the importance of the social rate of return lead us also to estimate it worldwide. In this new cross-country estimative we place high importance for the tertiary education and its human capital, scientists and engineers. As we shall see our results seems to corroborate with a targeted policy that use more intensively the university's knowledge as the base for economic development, especially through government incentives.

In our next step our focus changes to exporting high-tech products. The degree of development is linked to a certain level of international competitiveness. Thus, we look to the role of the university infrastructure as way of catching up high-tech export leaders worldwide. This innovative view has as objective to show the importance of having a strong university based on research processes as mean of reaching international level in economic development.

The reminder of this paper is organized as follows. We begin in Section II with a discussion about the most important aspects regarding the university's new role on developing R&D products, services and firms. Section III reviews the issue on social rate of return to R&D investment and estimate a new model that shows the importance of the tertiary education infrastructure. Section IV discusses the importance of R&D investment and entrepreneurial behavior as important elements for reaching new levels of exporting high-tech products.

II. The University Based Economic Development Process

Moving from producing ideas into producing "goods" requires some adjustment in the university itself. In our view this change in focus demands to learn about the overall environment for which the innovation will be made. Here, we will look into the literature for

more details on this new economic aspect of the universities. In our view there are three important aspects to be looked at. The macroeconomic aspects or the policies regarding the university as mean of economic development. The role played by institutional factors at the university, also known as the local policies conditions. Lastly, there are the entrepreneurship aspects of exploiting the innovation process - private enterprise and individual initiative.

The economics of intellectual property at universities became a field of economic research under the proposition of Audretsch (1995) and more recently by Link, Scott and Siegel (2003). By bringing this issue into evidence they have shown the importance of the research and development undergoing in the universities as economic mean and not just ideas that could be generated without economic return. According to Link, Scott and Siegel (2003) this transformation came by the Bay-Dole Act of 1980 that removed existing restrictions and made the commercialization process easier for the university. The importance of this Act was confirmed by Shane (2004) study. According to the author the Act led universities to concentrate their patenting in lines where business commercialization is more effective.[18] Thus, a macro policy is quite important in order to stimulate the innovation process at university level.

The commercialization barriers could be local, for instance at the university level. In this case it may discourage the process of transforming ideas into economic goods. Goldfarb and Henrekson (2003) evaluated the policy pursued in Sweden and US regarding the commercialization process of university-generated knowledge. Even though Sweden has the highest R&D spending relative GDP – Gross Domestic Product in the World during the past decade, the incentives for commercialization of intellectual property right is weak, according to the authors. This turns out in weak academic-based start-ups. The Swedish policies aimed at directing government funds to more entrepreneurial research ideas had lacked of direct

[18] A similar act the Small Business Innovation Development Act had similar effect in award recipients at NASA Langley Research Center. The researches there shift to more commercial potential projects; the projects experienced higher rates of commercial success; and there was a trade-off between basic research and commercial projects [Archibald and Finifter, 2003].

incentives to academic researches to get involved in the commercialization process of their ideas. This lack of entrepreneurial support and incentive for disclosure of their inventions gained importance in the study done by Jensen et al (2003). The existence of TTOs-Technology Transfer Offices not only solves the problem of commercialization of the idea, product or service, but also generates an economic incentive for scientists to disclosure their inventions at earlier stage. The same need for academic commitment to the entrepreneurial team engaged in the commercialization process was found to be fundamental by Vohora et. al. (2004).

One of the results of the commercialization process of an idea or patent is the potential for generating new firms, the so called start-ups. Besides the entrepreneurial commitment Gregorio and Shane (2003) observed three other important aspects for university success in start-ups. First, they posit to be the intellectual eminence of the university. The second aspect is a university policy that claims low inventors' share of royalties for the inventor.[19] And lastly, the university willingness to make equity investments in start-up companies – partnership.

We know that intellectual eminence is very hard to discuss at least economically. So, we focus on their expected result that is the capacity to produce radical technologies. Nerkar and Shane (2003) using a radical technology index studied the university start-ups survivals. They found that radical technologies by itself do not help to survive in every industry. It fails to provide an advantage to the new firm in concentrated industries and only works in more fragmented industries. Even though this study was based on MIT – Massachusetts Institute of Technology spin-offs, it can be used as warning for a strategy to be followed by researchers. The rate of success of their innovation depends upon their intellectual eminence in generating innovations for sectors of the economy that are less concentrated. Moreover, if industry

[19] Finding an optimal tax or royalty fees can be very important. In a model simulation Beath et all (2003) found that charging a optimal tax on academics performing research/consulting the university is able to increase its quantity of basic research.

environment does influence the research commercialization process then economic market studies might be required prior engaging in a research project.

This economic aspect of knowing the market for which the innovation will be addressed can be lessening in importance with the university-industry partnership. Link and Scott (2003) found that when the university has a formal relationship with a science park the following my happen: i) the university generates more patents; ii) hire prominent scholars; iii) and shift from basic toward applied research. This is quite important because science parks help to enhance the university research productivity and act as a spillover mechanism. As we can see the local environment for entrepreneurial activities is quite important for overall production and exploitation of innovations made.[20] Building tangible entrepreneurial infrastructure attached to a university based applied research as way of transforming regions would be a wise policy to be followed.

The importance of this tangible infrastructure is also supported in the view of Shane and Venkataram (2003) that analyzed several other studies. They found that the technology, the technical systems, and institutions are important mechanisms in the founding process of firms. The key element in their view is that science park attached to university is able to influence the propensity to emerge innovative entrepreneurs in a specific local or region. To influence the propensity of having more innovative entrepreneurs is the most important aspect of any economic regional development plan that is based on new technology. Moreover, this closes the circle by fostering the university to transform more ideas into "things" – tangible goods - that can be exploited economically which is the bases of any endogenous technological development.

[20] Local conditions that favor entrepreneurship activities may be due to a broader macro condition. Spencer and Gomez (2002) have studied these matters and provided interesting results.

III. The Social Return to R&D – Research and Development

As we shall see the fast growing literature on social rate of return to R&D has measured it within countries' industries, as a spillover effect between countries' industries and under overall cross-country effect. In this section we want to open a new venue in this literature by looking at the cross-country social rate of return to the university infrastructure. In this way our study follows Adams (1990) research that linked the academic science to productivity growth in US manufacturing industries. In his view the university's output in the form of papers, scientists and engineers are major contributor to that productivity growth. We want to use the core of his idea to measure the social rate of return due to university infrastructure and the number of scientists and engineers in a cross-country model.

The social rate of return to R&D became a very important mechanism of measuring the investment being made. Thus, the attention is not just on the direct return from the investment itself rather on the social or spillover effect of this investment. If the social rate is above the private one then public investment may be justified under a social premise.[21] This view is shared by Jones and Williams (1998) that found the optimal level of R&D investment to be at least two to four times below the actual level of investment in US.

The estimated rates of return to R&D at the industry level in US ranges from 17% to as much as 30% [Sveikauskas, 1981; Griliches, 1994]. However, when considered the social rate of return it goes to as much as 100% as in Scherer (1982) and Jones and Williams (1998). The other example of high social rate of return was found in Canadian equipment communication industry. Bernstein (1996) estimated it to be around 55% which is 225% higher compared to the private one.

The cross-country studies have also found a quite large social rate of return to R&D investment. The impact of 1% increase in business R&D investment is around 0.13% in 16 OECD productivity growth; however, the same amount of foreign R&D investment generates

[21] The social rate of return measures the benefit to the users from the R&D investment while the private rate of return to R&D measures the benefit accruing to the investors.

0,46% in the productivity growth [Guellec and Potterie, 2001]. This intra-country spillover was measured by Coe et al. (1997) through the social rate of return to R&D for 15 OECD countries. It was found to be 85%. Using a more complete panel dataset Lederman and Maloney (2003) found this rate to be between 20%-40% for OECD countries, an average 60% for medium income countries (Mexico and Chile), and 100% in poor countries (Nicaragua and Nigeria). The overall social rate of return is in the range 102% - 133% depending upon the sample size used.

The source of this international spillover effect is due basically to two sources. The first one is the international trade. According Cameron, Proudman and Redding (2004) trade helps enhance the speed of technology transfer. The second one is the foreign direct investment (FDI). The FDI has important implication for intra-industry spillover effects, especially for domestic firms [Damijan et all, 2003].

As we saw above, the social rate of return seems to more than justify government policies that subsidies R&D investment, foster trade open-up and stimulate foreign investment as mean of economic development based on R&D. Moreover, it also may justify a more intensive investment in existing or in the build-up of university based R&D projects as we saw in the previous section. The reason for this government intervention accrues from comparing it to the private rate of return proposed by Jones and Williams (1999) of 7%. There is a huge gain to be made by a R&D targeted policy towards a more intensive use of university infrastructure in our view. The social rate of return of a university based R&D investment is our main focus hereafter in this section.

III.1 – The Model

The support for an increase in university based R&D process as a mean of economic development can be obtained through an econometric model. We use Griffth (2000) simple

methodology in measuring that. Consider the following aggregate production function across country.

$$Y_i = A_i F(K_i L_i) \quad (1)$$

Where Y_i is the output obtained from combining the physical capital (K_i) and labor (L_i) in each country, and A_i is the total factor productivity (TFP). The TFP may be affected by several factors other them the stock of knowledge, H_i, which is our main focus here. Thus, the overall effect can be written in the log form as

$$Log\,(A_i) = \alpha_i + \xi Log(H_i) + \beta Log(X_i) \quad (2)$$

Where α_i represent country specific effects and X_i denotes all the other factors. The elasticity of output with respect to knowledge is $\xi = r_i*(H_i/Y_i)$ and $r_i=(\partial Y_i/\partial H_i)$ is the rate of the accumulation of knowledge. The knowledge is proxy by R&D investment, the flow of investment in knowledge.

Our objective is to estimate equation (2) by considering the role of tertiary education as potential proxy for stock of knowledge. The size of the social rate of return to this education infrastructure will enable us to see if there is room for R&D targeted policy.

When estimating equation (2), we will add an error term and other variables to control for omitted bias problem.

III.2 – The Variables

The variables to be used are the 1990's average R&D investment as a proportion of GNI-Gross National Income (RD90s) available in World Bank (2001); The 1990s log of TFP computed by Hall and Jones (1999); The Log of predicted share of an economy (LogFR) based on a gravitational model that uses only population and international trade, Frankel and Romer (1996); the fraction of population speaking one of five European languages (Eurfrac): Portuguese, French, Italian, Spanish and English from Hunter (1992); the 1990's average number of scientists and engineers per million in each country (Scieng90s), World Bank

(2001); the average human capital per worker (HL), Hall and Jones (1999); the average 1980's enrollment in tertiary education as percentage of gross enrollment (Tertiary80s), World Bank (2001); the average 1990's enrollment in tertiary education as percentage of gross enrollment (Tertiary90s), World Bank(2001).

The variables LogFR and Eurfrac were used by Hall and Jones (1999) to represent the exogenous social infrastructure of a country and therefore capture all the omitted variables. By social infrastructure the authors mean the institutions and government policies that determine the economic environment in which economic agents accumulate physical and human capital necessary to produce output. Taken together these two variables supposedly represent all the social-economic differences among countries or their fixed effects. Thus, our R&D investment variable would measure more precise the social rate of return because it would not be influenced by countries differences.

III.3 – The Social Rate of Return Econometric Results

Table 1 shows the econometric results os estimating equation (2). The models were estimated using OLS with robust standard errors. The econometric result in column 1 represents our baseline model. The social infrastructure represented by both variables LogFR and Eurfrac are determinants of the changes in TFP-Total Factor Productivity of the countries. The coefficient on the Log of RD90s (LogRD90s) is the elasticity of output with respect to knowledge ξ=0.18. In order to compute the social rate of return to R&D investment we use the sample ratio $H_i/Y_i = 0.23$. Using these two values we have that the $r_i = 0.78$ which give us an average social rate of return to R&D investment of 78% for our sample of countries. This result is within the range obtained by the previously mentioned authors.

In column 2, we have added the human capital per worker proposed by Hall and Jones (1999). They computed the human capital through a piecewise decreasing function having average years of education as the main variable. This variable was not significant. Moreover,

the coefficient on LogRD90s remained the same, thus giving us the same social rate of return as the one in Column 1. This result is interesting because tell us that the overall stock of knowledge of the economy is not the main element, so we have to find a more specific one.

The use of scientists and engineers did change the previous results, Column 3 in Table 1. Now the coefficient on the LogRD90s is no longer significant. This is a clear indication that the number of scientist and engineers are the determinant factor of R&D investment. Using its coefficient as the output elasticity of knowledge we find a social rate of return to R&D of 61%. This is lower than the previous one, but it is more than eight times (8.71) higher compared to the standard 7% proposed by Hall and Jones (1999).

Columns 4 e 5 estimates the importance of the university infrastructure through the proxies Tertiary80s and Tertiary90s. Using their coefficients as the output elasticity to knowledge stock we find a social rate of return of 100% and 161%, respectively. This can be interpreted with some caution as an increase in the social rate of return to R&D investment caused by university infrastructure growth in the 1990s. The caution is regarding the potential for contemporaneous endogenous problem in the latter coefficient, Tertiary90s. There is chance for a feedback effect going from R&D investment to university infrastructure build up in the 1990s. Recall that this infrastructure has risen from 2.47% in 1980s to 2.97% in the 1990s of the total gross enrollment in our sample. Measuring the impact of this infrastructure overtime would be an extremely important aspect to be looked at in future research.

Our estimates lie within the range of studies that did take into consideration a broad sample of countries in a panel dataset and also considered all the potential endogenous problems, e.g. Lederman and Maloney (2003). The social rates of return to R&D investment estimated by us do show a room for a targeted R&D policy. This targeted policy may be aimed at building or improving university related infrastructure as in Section II like science parks, labs, multipurpose plants as mean of generating new high-tech products and firms. In

the next section we look for the importance of this infrastructure for producing and catching-up leader countries in high-tech product exporters.

IV. The Determinant Factors of High-Tech Exports

The export of high-tech products is a very good way of measuring countries international level of productivity. In this section we look for factors that influence the production and export of high-tech products as percentage of its manufacturing exports. Taking US as the leading country we make export of high-tech goods as percentage of manufacturing export of all countries relative to US. This relative measure enables to see which country is improving relatively to US regarding its international productivity.

As we saw in Section II there is clear need for entrepreneurship commitment in the process of producing innovation. Therefore, we look for the entrepreneurial class size as a proxy for this commitment. We do believe that the entrepreneurial class size is endogenous and depend upon very much on the social infrastructure [Baumol, 1990; Murphy, Shleifer and Vishny, 1991; Dias and McDermott, 2004].

Our average entrepreneur class size in the 1990s' variable (Ent90s) comes from ILO-International Labor Organization.[22] The social infrastructure is again an important factor in determining the entrepreneurial class size. Here, we proxy this variable through the following combinations: i) the log of Frank and Romer (1996) index; ii) the fraction speaking English as a mother tongue (Engfrac) from Hunter (1992); and iii) the control variable average output per worker in 1980s from World Bank (2001). Again this set of variables was used to represent social infrastructure as in Hall and Jones (1999). We add to these variables the government cost for entrepreneurs to set up a business (Costgov) from Djankov et all (2002). The latter variable represents the prevailing economic policy towards entrepreneurship in the

[22] We use the dataset in www.ilo.org to compute the percentage of entrepreneurs as percentage of the workforce in the economy by using the ISCO-International Standard Classification. The ISCO-1968 codes used are 2.0 and 2.1 and the ISCO-1988 codes 11, 12 and 13.

economy. Together we believe these variables captures the most important aspects of the entrepreneurial behavior of the economy.

The other important aspect in the economy is related to the determining factors of R&D investment. By considering this variable to be endogenous we follow the cross-country studies done by Varsakelis (2001), Bebczzuk (2002) and Lederman and Maloney (2003). Our approach differs from them by positing it to be a key element in determining high-tech export. Under this view, R&D investment is a function of existing stock of knowledge, international trade, market competitiveness, and the rate of return to assets.

Here we describe the variables that determine R&D investment and their sources. The stock of knowledge used is the 1990s' average number of scientists and engineers per million people (Scieng90s) from World Bank (2001). The international trade is proxy by the variable years open index (Yrsopen) build by Sachs and Warner (1995). The international trade index variable enters in explaining R&D because it helps transfer and speed-up R&D investments. The product market competitiveness index (Markcom) proposed by Djankov et all (2002) is used as a proxy for the prevailing competition in the economy. We believe that a more competitive market requires innovation, thus influencing the level of product competitiveness through R&D investment. The rate of return on assets (Roa) also comes from Djankov et all (2002). This variable captures the average return on assets in the economy leaving out any marginal return due to R&D investment. And lastly, we add a control variable to capture pre-existing conditions through the average physical capital stock per worker in 1980s (Kpw80s) from World Bank (2001).

IV.1 – The High-Tech Export Econometric Model

Once we have determined the level of entrepreneurship and the R&D investment we use them to explain the high-tech export as percentage of manufacturing export relatively to US. This three stage process gives us the opportunity to better understand the role of the

policies regarding entrepreneurial activities and university infrastructure related to R&D investment as a mean to achieve international market competition. Thus, our econometric model is as follow:

$$Y_{1i} = \alpha_{1i} + \beta_{1i}X_{1i} + \varepsilon_{1i} \quad (3)$$

$$Y_{2i} = \alpha_{2i} + \beta_{2i}X_{2i} + \varepsilon_{2i} \quad (4)$$

$$Y_{3i} = \alpha_{3i} + \beta_{31}Y_{1i} + \beta_{32}Y_{2i} + \varepsilon_{3i} \quad (5)$$

Where equation (3) determines the entrepreneurial behavior prevailing in the economy; equation (4) is the key for determining the R&D investment; and equation (5) represents the high-tech export goods as function of the two previous equations. The error terms are assumed to have the following behavior $E(X_{1i}, \varepsilon_{1i})=0$, $E(X_{2i}, \varepsilon_{2i})=0$ and $E(Y_{ji}, \varepsilon_{3i})=0$ where j=1,2. In order to comply with these conditions we use the SURE-Seemingly Unrelated Regression Method. All the results are reported in Table 2. This table is divided into three set of equations. The first set of equations explains the entrepreneurship behavior. The second explains the R&D investment. The third one shows the specification for the high-tech export relative to US.

In explaining entrepreneurship behavior, we have kept the same specification across columns (1)-(5). The objective was to capture the combination of social infrastructure and government behavior. The entrepreneurship class is marginally affected by the size of the economy – average output per worker in 1980s - (Yw80s). The social capital or infrastructure represented by the variables Logfr and Engfrac do explain in a positive way most of the entrepreneurship behavior of the economy. The Logfr index is the predicted share of an economy, based on a gravity model of international trade that only uses population and geographical features of a country; the Engfrac is the English speaking fraction of population. Both variables are key elements in explaining social infrastructure in Hall and Jones (1999). This means that countries influenced by Europeans tend to have social infrastructure that is more conducive to entrepreneurship behavior. However, as one may notice, there is still room

for government policy. Especially policies regarding the bureaucracy cost of setting up a business. As matter of fact the variable Costgov showed to be negative and quite significant.

IV.2 – The High-Tech Export Econometric Results

The R&D investment (RD90s) regression in Column (1) of Table 2 is our baseline model. There we can see that the stock of knowledge represented by the amount of scientists and engineers per million people allocated to the R&D sector (Sciengrd90s) is the key element in determining the level of R&D investment. The rate of return to assets (Roa) showed to be positive indicating that economies with high rate of returns tend to invest more on R&D. The years open variable (Yrsopen) did confirm the importance of openness as way to boost R&D investment. The market competitiveness index (Markcom) showed to be negative. We are expecting that more competitive economy would invest more in R&D. It requires more investigation on the causes.

Still on the R&D specification, Column (2) adds the amount of credit to private sector (Dcbanking90s) to see its influence. The result is positive in every specification showing the importance of available credit to companies and its indirect influence on R&D investment. In Column (3) we replace the Sciengrd90s for Tertiary80s to see the importance of the tertiary education infrastructure on R&D investment. The existence of tertiary education infrastructure previously is quite important for R&D investment. Thus, it corroborates with our thesis on the importance of taking advantage of universities infrastructure as way to enhance R&D investments. Columns (4) and (5) replicate the previous specification, but adding domestic credit to companies by the banking sector (Dcbanking90s). In both cases the tertiary education showed to be significant as well as the availability of credit to companies in explaining R&D investments.

The last set of regressions explains the high-tech exports relative to US. Looking at the variables along the rows, we see that the stock of capital per worker (kpw80s) is

negatively related to exporting high-tech products. This means that physical capital investment is not a key element for a country to catch-up US in the high-tech export business. As a matter fact our hypothesis that high-tech export depends upon R&D investment (Rd90s) and Entrepreneurship policies (Ent90s) proved to be right. Both variables show to be significant and positively related to high-tech export goods relative to US. Economies where competitiveness is present tend to export more easily high-tech products as showed in Columns (1)-(3) by the variable Markcom. Column (4) tests the importance of ISO-International Standard Organization certification. The Isoqual variables helps companies to meet international standards and by extension countries to export more high-tech products. We use this variable as a proxy for entrepreneurship quality of the country. Therefore, both variables when combined state that quantity and quality of entrepreneurship matters for exporting high-tech products. As a last specification in Column (5) we use the private cost of setting up a business as a proxy potential intermediation cost of exporting goods in each country. It showed not to be significant.

V. Conclusion

This research supports a regional economic model that has the university as the centerpiece for producing ideas, goods and firms. The social rate of return to R&D investment proved to be quite high, especially when we considered the university infrastructure in our model. Moreover, it may require changes in laws and existing universities behavior to make it a more entrepreneurial activity, especially regarding the commercialization of its products. By linking the university to a science park may solve the entrepreneurial problems of the economy and by extension the university itself. The good news is that the above combination of entrepreneurial and R&D investment policies seem to help the economy to export high-tech products. Hence, our main conclusion is that any successful economic development plan must combine a university infrastructure that is conducive to entrepreneurial behavior and

exploits the R&D investment as mean of producing high-tech products and companies. In sum, we found that

i) there is a high unexploited social rate of return due to university infrastructure, above 100%;

ii) it is not the size of the economy that matters for entrepreneurship, but the social infrastructure and government policy that incentives entrepreneurial activities like less bureaucracy;

iii) an economy where the university infrastructure produces scientists and engineers also have more R&D investments;

iv) economic policies that that lead the economy to be more open and to have an asset market more developed also generate more R&D investments;

v) entrepreneurship behavior and R&D investments are key elements for a country to export high-tech products and not the physical capital as one may think it is.

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Annex.

Table 1: The Social Rate of Return to R&D Investment
Dependent Variable Log of TFP (LogA).

Variables	Coefficients (1)	Coefficients (2)	Coefficients (3)	Coefficients (4)	Coefficients (5)
LogFR	0.23 (0.08)*	0.23 (0.09)*	0.20 (0.09)*	0.22 (0.06)*	0.018 (0.06)*
Eurfrac	0.71 (0.14)*	0.71 (0.14)*	0.66 (0.16)*	0.56 (0.13)*	0.50 (0.14)*
LogRD90s	0.18 (0.05)*	0.18 (0.06)	0.02 (0.07)	0.09 (0.05)***	
LogHL		0.03 (0.31)			
LogScieng90s			0.14 (0.05)**		
LogTertiary80s				0.23 (0.07)*	
LogTertiary90s					0.37 (0.08)*
Constant	7.44 (0.27)*	7.42 (0.34)*	6.58 (0.43)	6.89 (0.28)*	6.43 (0.33)*
N	50	50	47	47	47
R^2	0.48	0.48	0.51	0.55	0.63

Notes: * significant at 1%; ** significant at 5%; *** significant at 10%. Variables with Log in front of its name are in logarithms. The values underneath the coefficients are their robust standard errors.

Table 2: Explaining High-Tech Export

Variables	(1)	(2)	(3)	(4)	(5)
Ent90s					
Yw80s	9.38e-07 (5.38e-07)***	9.65e-07 (5.5e-07)***	8.80e-07 (5.67e-07)	7.22e-07 (5.48e-07)	7.02e-07 (5.46e-07)
Logfr	0.007 (0.002)*	0.007 (0.002)*	0.008 (0.003)*	0.009 (0.002)*	0.009 (0.002)*
Engfrac	0.055 (0.013)*	0.055 (0.013)*	0.056 (0.014)*	0.052 (0.014)*	0.053 (0.013)*
Costgov	-0.008 (0.003)*	-0.009 (0.003)*	-0.007 (0.003)*	-0.009 (0.003)*	-0.008 (0.003)*
Rd90s					
Sciengrd90s	0.481 (0.079)*	0.408 (0.077)*			
Roa	2.908 (1.107)**	2.898 (1.006)*	2.510 (1.483)***	2.208 (1.147)**	2.165 (1.154)**
Yrsopen	1.295 (0.275)*	1.050 (0.261)*	1.058 (0.363)*	0.772 (0.292)*	0.772 (0.293)*
Markcom	-0.676 (0.122)*	-0.634 (0.111)*	-0.104 (0.085)	-0.169 (0.070)*	-0.170 (0.070)*
Tertiary80s			0.032 (0.010)*	0.027 (0.008)*	0.028 (0.008)*
DcBanking90s		0.005 (0.001)*		0.007 (0.002)*	0.007 (0.001)*
Htex90us					
Kpw80s	-1.05e-05 (4.84e-06)**	-9.72e-06 (4.86e-06)**	-9.38e-06 (4.85e-06)**	-8.55e-06 (4.68e-06)	-9.45e-06 (4.83e-06)**
Rd90s	0.246 (0.124)**	0.211 (0.125)***	0.227 (0.121)**	0.240 (0.124)**	0.248 (0.125)**
Ent90s	3.949 (2.282)***	4.028 (2.293)***	3.894 (2.329)***	4.775 (2.301)**	4.957 (2.295)**
Markcom	0.077 (0.035)**	0.078 (0.035)**	0.072 (0.035)**		
Isoqual				0.623 (0.288)**	0.584 (0.291)**
Costpriv					4.1e-05 (6.4e-05)
N	33	33	33	33	33
R^2-Ent90s	0.93	0.93	0.93	0.93	0.93
R^2-Rd90s	0.90	0.92	0.84	0.89	0.89
R^2-Htex90us	0.62	0.56	0.62	0.56	0.56

Source: Authors Calculation. Notes: * significant at 1%; ** significant at 5%; *** significant at 10%. The values underneath the coefficients are their robust standard errors.

Supporting university based start-ups within an environment with a low culture of entrepreneurship

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INTRODUCTION

Slovenia is a small economy with the per capita GDP below the EU average. Its development strategy is to "catch-up" with the EU. To strengthen its competitiveness, the innovation and entrepreneurship should become the key drivers of its economic growth that has to surpass the EU performance. However, there exist neither a strong tradition of entrepreneurship culture in Slovenia nor are the key institutions of a "knowledge-driven" economy ready for the new development paradigm.

As a small country, Slovenia only has three universities, with the largest one, University of Ljubljana, still traditional and conservative in its concept of university-industry collaboration. Since the technology transfer from universities to industry is one of main weaknesses of the economy, government recently conceived a more aggressive approach to the change by supporting entrepreneurship infrastructure at universities and at some leading R&D institutions and companies.

The paper will analyze the development of LUI, the Ljubljana University Incubator during 2002-2004 as the case of an institution geared towards supporting university spin-offs within an academic environment that represent more a barrier than a support.

THE BACKGROUND

By its economic parameters, Slovenia is the most developed transition economy. However, its index of economic liberties and the entrepreneurship culture lag behind its economic performance. Further liberalization of Slovenian economy is necessary where a strong SME sector and corporate venturing are the keys to structural changes.

State of entrepreneurship culture in Slovenia

While the first half of 1990s created a strong SME sector by the number of new businesses, jobs created and market niches covered (Glas and Drnovsek, 2000), this wave of entrepreneurship still shows some deficiencies:

- the process of new venture creation has been virtually stalled after 1995 and the number of businesses even declined lately,
- new ventures are mostly micro-businesses of the "life-style" character and few enjoyed dynamic growth,
- few SMEs really created new products and services, they prevailed in traditional sectors and the level of technology has not supported high value added activities.

Slovenia joined the Global Entrepreneurship Monitor (GEM) research since 2002. Two annual reports show quite a disappointing picture of entrepreneurship: the TEA (Total Entrepreneurship Activity) Index placed Slovenia with 4.63 (GEM average: 6.88) at the 25th place among 37 countries in 2002, while the performance worsened in the year 2003: with 4.05 Slovenia was placed 24th among 31 countries. In a consolidated picture for the period of 2000-2003, Slovenia would earn the 36th place among 41 countries. Further weakness is highlighted by the fact that Slovenia ranks worse on opportunity-based vs. necessity-based entrepreneurship: there is the lack of searching for new opportunities. The research on motivation for start-ups revealed the autonomy and not opportunity as the most important

factor (Glas and Drnovsek, 2000) what leads to "life-style" not growth attitude. Only among dynamic enterprises a profitable opportunity and challenge seemed to be the main motive (Zizek and Liechtenstein, 1994; PHARE report, 2002).

In both GEM Annual reports Slovenian experts consistently ranked the conditions for entrepreneurship related to government policies and structural support to SME development as weakest. Experts use to be fierce critics of government's actions, sometimes understating the efforts of the Ministry of Economy to introduce a modern competition policy, but this picture sends a serious warning to Slovenian politics.

By the stereotype Slovenians are risk averse people. The national culture does not support individual success, acquired through own efforts and hard work. The egalitarian values inherited from the socialism are very strong and they resent individualism, independence and personal initiative. Government is expected to take care of individual's well-being. GEM Report 2002 sees the problems with cultural and social norms in some anti-entrepreneurship concepts:

- low tolerance for increased income and wealth differentials,
- highly negative attitude and stygmatisation of business failures,
- controversial attitude towards commercial approach within some social activities e.g. education, health, culture, opposing personal financial inputs into these activities,
- expecting government to provide assistance in case of social problems,
- harsh, unforgiving attitude towards unemployed persons,
- low level of public confidence in government institutions etc.

GEM Report 2003 stated that becoming rich in Slovenia is not always socially acceptable, even if resulting from the honest and productive business and entrepreneurship activity. The report called for an adequate reward system for creativity, innovation and entrepreneurship if scarce talents were to push their own projects. This social setting could be

traced back to the historical tradition of Slovenians as farmers, traders and artisans, not really people from industrial and financial community (Glas, 1998).

The academic sphere and entrepreneurship

The academic sphere in Slovenia represents a weak link in the process of technology transfer and creation of applied technology research as proven by the research on the competitiveness of Slovenian economy. Slovenia is lagging behind some less developed former socialist countries not only behind the EU countries.

Figure 1. The assessment of the university - business technology transfer

This ranking is further supported by the findings of the PHARE Report (2002) that discussed the university spin-off incubators in Slovenia:

- the global R&D spending as a percentage of GDP as well as the number of full-time equivalent researchers per 1000 active population in Slovenia are only slightly below the EU average, but less R&D is done in companies and there are only few innovative firms among SMEs;
- the level of business/entrepreneurship education in Slovenia is moderate, lower in the science and technology areas; academic and research circles have limited business experience and scarce business contacts that hinder faster research commercialization;
- public RD spending is supporting the survival of large research institutes and it is not geared towards technology needs of the private sector;
- no true seed funds are available for NTBFs, either by formal venture capital funds or “business angels” and the access to seed and expansion capital is a major concern for founders of new technology companies;

- R&D spending in companies is low, especially at SMEs; firms are oriented more towards real estate investments than towards investments in R&D, new knowledge and intellectual property.

The role, universities play in Slovenia, is far from the intentions of the European Commission as put in its communication (2003). Some academic staff and departments with international experience nurture a different culture, but as the whole, universities have a tough agenda to change. However, to be fair to the academic community, this picture resulted from some trends in the development of higher education, where universities had no direct influence:

- the number of students increased enormously during 1990's, and the academic staff, financial resources, premises and research equipment felt short of this increase,
- the system of higher education financing stimulated the number of programmes and not the efficiency and quality of teaching and research,
- the average financial means per student are much lower than in EU countries,
- level of professional and financial autonomy of universities was rather low and the procedures to change curricula and introduce new courses and programmes were quite cumbersome, discouraging dynamic changes according to new demands,
- former barriers for international mobility of staff and students are still taking a toll on the research excellence and publishing of teaching / research staff,
- Slovenian companies are too weak to present a serious research and financial partners to universities e.g. as a source of additional revenues, etc.

Entrepreneurship infrastructure in Slovenia

The movement towards SMEs in Slovenia resulted in late 1980s from the strong private crafts sector and from a group of academic people attracted by the entrepreneurial "silent revolution" in the United States and later development in Europe. They also promoted

the concept of incubators but early promising developments failed due to the lack of own premises and real financial support and few developed during 1990s. Two technology parks, one in Ljubljana by the Jozef Stefan Institute and the Styria TP in Maribor by its municipality, were founded.

In the same time, the SME Support Network at the local and regional level gradually evolved, with the Small Business Development Center (SBDC) as the strategic leader and three Euro-Info centres. However, universities newer got really involved as strong partners to this network, although vast intellectual resources were available.

The entrepreneurship education and training developed quite successfully at all levels, mostly as part of private initiative and individual efforts. However, it only developed at economic faculties, while science and technology departments never embraced the business initiative among their students and staff (Glas and Menzies (2001), Glas, Petrin and Vahcic (2001) and GEM Report 2002). Still, education and training got high score with experts in GEM: best ranking on the 9th place in 2002, a little more critical 13th and 17th place in 2003. The Centre for Entrepreneurship Development was established at the Faculty of Economics in Ljubljana (Glas and Drnovsek, 2001) and the Institute for Entrepreneurship and SME Management at the Faculty of Economics and Business in Maribor. Recently both centres initiated the creation of university incubators in 2002 with initial funding provided by the government.

Within such an environment, there were some stimuli to push for more entrepreneurship initiatives, but also some barriers.

Table 1. A tentative list of stimuli and barriers for entrepreneurship at the University of Ljubljana

UNIVERSITY INCUBATOR IN LJUBLJANA

The academic group at the Chair for Entrepreneurship Studies for almost a decade advocated an university incubator. However, the government (Ministry of Education and Science), the City Municipality of Ljubljana or the university as key possible stakeholders never thought of providing necessary resources. The concept of incubator was inconceivable with the traditional academic community and other institutions did not consider university as a serious player in the entrepreneurship development:

- the rector of University, Professor Joze Mencinger, although a macroeconomist by his profession, a strong opinion-maker, explicitly stated his doubts about the necessity and the effectiveness of incubators and technology parks;
- academic community failed to embrace the idea of an incubator as a vehicle for the commercialization of research or an option for alternative career path for younger teaching and research staff,
- mayors of Ljubljana never attempted strong efforts to spark technology oriented firms,
- national government did not push for university incubators since entrepreneurship and SME development only recently got the status of key generators of growth and welfare;
- SME owner-managers, quite a number of them former craftsmen, did not expect strong impact from an university incubator so their associations never pushed the idea.

After a PHARE study confirmed the viability of two university spin-off incubators in Ljubljana and Maribor, with the third at Nova Gorica (Politehnika) government decided to sponsor the pre-start research and preparatory activities through a tendering process. While in Maribor, through a cross-border programme, the incubator was already provided with some premises, the activity in Ljubljana started from scratch.

The pre-start period of LUI

In Ljubljana two stakeholders promoted the initiative to create a project group to participate in the tender:

- the teaching staff at the entrepreneurship department at the Faculty of Economics, with its Centre for Entrepreneurship Development,
- manager of the Ljubljana Technology Park (TPL).

TPL, established in the mid-1990's by some institutes and leading firms, has already proposed to the University of Ljubljana the co-operation in promoting and supporting new business ideas of students and staff, however with little success. The manager of TPL provided the technical support to a group of teachers from five departments: Faculty of Biotechnology, Faculty of Electrical Engineering, Faculty of Pharmacy, Faculty of Chemistry and Chemical Technology and Faculty of Economics. After few meetings, where the concept of incubator has been thoroughly explained, the group applied for the project at the Ministry of Economy. With five deans and the initial group in consent, the university leadership accepted the initiative. The project got the budget of €45.000 for the Phase one, and the group performed several activities:

- the Initial Project Group was created with representative of all five departments and the Technology Park as partner,
- the initial group visited selected European university incubators and science parks: in the UK, they visited universities at Cambridge and Oxford and participated at the annual conference of university incubators in Manchester, in Austria, technology parks in Graz and Leoben were visited, as well as the lead institution, TIG in Vienna, in Italy BIC Trieste and the Area Science Park close to Trieste were visited,
- a broad marketing research among students, academic staff and high-growth SMEs in Ljubljana region has been undertaken: 850 undergraduate and 83 graduate students filled a questionnaire at all five participating departments, 90 members of teaching and research

staff responded and 47 dynamic SMEs in the region were asked about their intentions about corporate venturing,

- a standard business plan for the establishment of the incubator has been developed and proposed for the Phase two to the Ministry of Economy.

From the very beginning, the project group started to build a network: financial institutions e.g. Horizonte Venture Fund and Kmecka Druzba Investments, the only venture capital investors with some deals in Slovenia participated, as well as the Small Business Development Centre as a national institution and the Centre for Small Business Development from the City of Ljubljana were also in touch. The motivation of academic stakeholders were mostly:

- to create an institution important for the future development of the university offering students practical experience in working with spin-off firms,
- to offer new opportunities for business activity to target groups at the University of Ljubljana, to students and staff: improving the image and the competitive position of the University of Ljubljana, it should help to curb "brain drain" from Slovenia by offering opportunities to develop new projects at home and it should be used to establish better relationships with Alumnis from the university,
- it should provide a tangible impact of University of Ljubljana on the local/regional economic development by nurturing technology oriented ventures,
- it could become a new source of revenues for the University of Ljubljana through the commercialization of its intellectual property.

The project group assumed three target groups for potential tenants of LUI, with different objectives, experience and career options:

- undergraduate and particularly graduate students due to their working experience and stronger financial status,

- academic staff: teaching, research and other technical staff,
- external founders, mostly from the Alumnis, with technology oriented projects.

Figure 2. The role of LUI as assumed in its business plan (2003)

According to the world experience, the project group expected a smaller share of high-tech projects, mainly from the academic staff that could bring to the market their expertise through a number of service and consulting businesses, and graduate students, while undergraduate students are expected to create all kinds of "campus businesses", focused on the needs of the student population and other customers. LUI could be used by several research groups that enjoyed 3-5 years of public funding (at least part of their budgets) to provide additional 3-5 years of the development of products and services resulting from the applied research.

While the project has been mostly "tolerated" and never really encouraged by the university leadership, the marketing research revealed a more promising picture of the potential for new venture creation:

- 5.5% of students want immediately after finishing their studies establish own firms, while 44% intend to find corporate jobs,
- 99% of students want to develop their entrepreneurship skills, 32% would like to have an obligatory course on entrepreneurship,
- even 60% of students would establish a firm if properly assisted,
- in 5 years after finishing studies 18% undergraduate an d even 32% of graduate students plan to found own businesses (14% of graduate students, mostly at the Faculty of Economics, already possess own business),
- from LUI they mostly expect: financial assistance, information and advice as well as premises with subsidized rents,

- among teaching staff 12 % expect to have own firm in 5 years while 7% already have one.

With more than 55.000 full- and part-time students at the University of Ljubljana, these figures reveal an important potential for new venture creation.

Establishment of Ljubljana University Incubator

The incubator was a new concept at the University of Ljubljana, and the formal procedure of approving the decision to found such a unit has been respected and a number of decision-making bodies notified or asked for approval: the deans of all five participating departments, the Senate, and ad hoc commission set up by the Senate, dean's assembly, the Management Board, and the rector's collegiate board. An important step in championing the incubator was the election of the new chairman of the Management Board after the previous one left for the post of the Minister of Finance in the national government. A member of the Entrepreneurship Chair was elected to this second highest post in the university hierarchy, so the support for LUI project has been ensured.

A positive consensus has been built at the level of all these bodies, with the only demand that LUI be open also for the staff and students of other departments and the financial situation be closely monitored to avoid financial risks. It was not a real enthusiasm among stakeholders, but the tacit agreement that University of Ljubljana needs such an institution has been created.

As a public institution, university needs governments approval to establish the incubator. The process of getting this approval revealed why the "Anti-Bureaucracy Program" is important in Slovenia:

- the documentation was delivered to the Ministry of Education, Sport and Science, covering the higher education;

- an inter-ministerial procedure among the Ministry of Economy, Ministry of Education and Ministry of Finance lasted for months due to incomplete legislation,
- Ministry of Finance found out that university as public institution is not allowed to fund LUI as a limited liability company from its own financial resources – project group had to find a private organization to sponsor the founding capital of € 8.000: an investment company with a manager very much in support of entrepreneurship provided the resources (the option was that project group would contribute the money),
- the notary studied the founding contract – University being the founder with the initial departments having representatives in the governance bodies of LUI – and after a long discussion and some interventions from the University proposed the documentation to the Registration Court which respond immediately on a personal request).

It took eight months to pass the whole procedure although the project was in fact a government sponsored project. During the initial discussion on the organizational and financial structure of LUI, the collaboration between University of Ljubljana and the Technology Park (TPL) crashed since TPL demanded LUI to keep only the pre-incubation stage and to direct all mature projects immediately to TPL. This demand would deny LUI the real incubator activity and the chance to develop appropriate intellectual property structure to cash in on university knowhow. LUI decided to establish the incubator with University of Ljubljana as the sole owner but to keep future co-operation with TPL open.

During the whole period of administrative procedures, LUI already started some activities:

- promotional events at the departments collaborating in the project (another Faculty of Mechanical Engineering, very strong at university – industry collaboration, joined the project),
- identifying entrepreneurial teams with viable projects,
- initial training and the business basics and business plan preparation,

- establishing Information Points as pre-incubation units at all the departments, with a room and some computer equipment to establish the first stage of the promotion and idea identification,
- searching for sponsorships at financial organizations,
- developing the network of supporting institutions,
- finding the premises for the central incubation unit where entrepreneurial groups with mature and approved business plans would enter the real incubation process.

In June 2004 LUI was formally established, its governance structure appointed and the manager, a graduate from the Faculty of Mechanical Engineering, took over executive functions from the project group.

LUI: VISION AND REALITY

The concept of LUI, although conceived as a "simple" university incubator at the stage one, is much more ambitious: it has to become the focal point in the development of entrepreneurship curriculum at University of Ljubljana, a vehicle for an intense university-business collaboration and an option to career development of some academic staff and students.

Figure 3. The vision of LUI as the focus of entrepreneurship development

Since it is the weakness in entrepreneurship education not to be appropriately introduced at science and technology departments, LUI would be used as the focal point to bring entrepreneurship training and experience to these students and staff and later to enter the new Bologna-based curricula. LUI would link different existing or newly created knowledge generating institutions at University of Ljubljana.

Figure 4. Organisation and network structure at LUI

How far this vision of LUI will really materialize depends on a number of issues discussed currently within the project group, formal governance bodies and the expert groups. LUI is just a link in the whole organizational structure that is itself still weak while other links have yet to develop. The problem is with the dispersion of the departments over the whole area of Ljubljana which makes it difficult to establish the co-operation among staff and students from different departments, with important issues of logistics and coordination. It is highly important to prove that LUI could really provide good assistance to entrepreneurial teams and that viable projects exist and could be implemented. The most important issues are:

1. Establishing a capable management team (up to 3 persons) and expert pool (5-8 members) at the main incubator that will start to work with would-be entrepreneurs early in their idea development stage – the info-points at all departments do not provide well this function due to unequal knowhow and lower level of efforts than expected.
2. Enhancing promotion at all departments – initial members and others, raising awareness on entrepreneurship and LUI existence, to be able to direct all initiatives to LUI to prove the venture creation potential among target groups of LUI.
3. To provide appropriate premises for LUI, located close to science and technology departments – a PHARE project is still under consideration to provide the bulk of resources. LUI as a "virtual incubator" could hardly provide the focal point assumed. This issue could be best solved through the co-operation with TPL and the future Technology Zone.
4. Creating a nucleus of first entrants to LUI to prove the concept and start developing the image of a viable and effective institution.

Although the activity of the project group and the LUI manager have focused on the procedure of formal establishment, they identified 12 entrepreneurial groups already working on their business ideas and the process of the evaluation and the disbursement of initial financial support is underway.

Table 2. Entrepreneurial teams at their initial stage

Table 2 reveals a variety of projects, a combination of services and production (usually more assembly of existing parts). The most distinct feature of the list is the fact that 10 out of 12 projects are teamworks which is quite unusual for local environment where only few successful partnerships exist and entrepreneurs are not highly enthusiastic about working with partners unless from the same family. While the PHARE research assumed that spin-off incubator should analyze and support 30-50 projects annually to get to 3-5 spin-offs per year, the current result show that more efforts should be put to reach such a number of projects and that the success rate of one in ten "ideas" coming from research is quite realistic, with the projects of academic staff and graduate students being able to provide even better output.

CONCLUSION

The idea of an university spin-off incubator at the University of Ljubljana was for years "a dream" of the academic group at the Entrepreneurship Chair at the Faculty of Economics. Only recently, through the financial support of the government, the project was initiated. The two years since the inception phase in 2002 show that within an environment with low entrepreneurship culture it takes enormously strong energy and a lot of time to establish a new institution. Even with some "guerilla" actions to create the support of the university, a number of unexpected details hindering the project have to be expected and a lot of patience is recommended to make the progress.

The project group with members from different departments proved the existence of highly divergent understanding of entrepreneurship, a lot of reservations and low level of flexibility among the people from the science and technology departments not used to the quantity of barriers. Also, separate individual "by-pass" projects of some academic people created lots of reservations since those people were not supporting transparent dealings within the incubator setting that might limit their own earnings.

LUI has still to prove its viability and efficiency and more time is needed to get to an established institution. It is certainly the question how far the whole project might reach in 3-5 years, but the existence of the potential is beyond any doubt and the diversity of ideas is encouraging. While students created a surprise with their prevalence of teamwork, academic staff has still not joined the process as much as expected. However, it is not the absence of business ideas behind their reluctance, but rather the practice of own "by-pass" businesses that evade the university control that makes them uncertain about the benefits of doing business through LUI: they would have access to a lot more of resources, the conflict of interest issue would be avoided and professional services offered. LUI has to prove its usefulness to this target group as well if it is to develop the whole vision of a focal point for entrepreneurship education and new venture creation processes at the University of Ljubljana.

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Table 1. A tentative list of stimuli and barriers for entrepreneurship at the University of Ljubljana in the period 2001-2004

Stimuli for entrepreneurship development
• Financial support of the Ministry of Economy • Parallel projects of this ministry (applied R&D support measures, clustering) • Strong group of academic staff on entrepreneurship at the Faculty of Economics • Changes in the system of financing towards performance-based criteria • Good relationships with some leading world and European universities • Encouraging experiences with some student entrepreneurial teams • Support of Ljubljana Technology Park • Strong entrepreneurship programme at the Faculty of Economics • Strong interests of students at some departments, partly staff and dynamic SMEs • Available research equipment and knowhow • Administrative barriers for effective founding of LUI and tenant companies
Barriers for entrepreneurship initiatives
• Tendency to slowdown in the world economy and Slovenian economy • Low level of entrepreneurship culture in Slovenia and among the university staff • Lack of entrepreneurship courses and experience at science and technology • Lack of support at the level of university management (rector) • Lack of start-up (seed and expansion) capital • Divergent interests of some academic staff to retain commercial activities through their own businesses (conflict of interests) • Unregulated issue of intellectual property rights at the University of Ljubljana • Criteria of academic performance denying practical contribution through the transfer of technology to business

Figure 1. The assessment of the university - business technology transfer in Slovenia

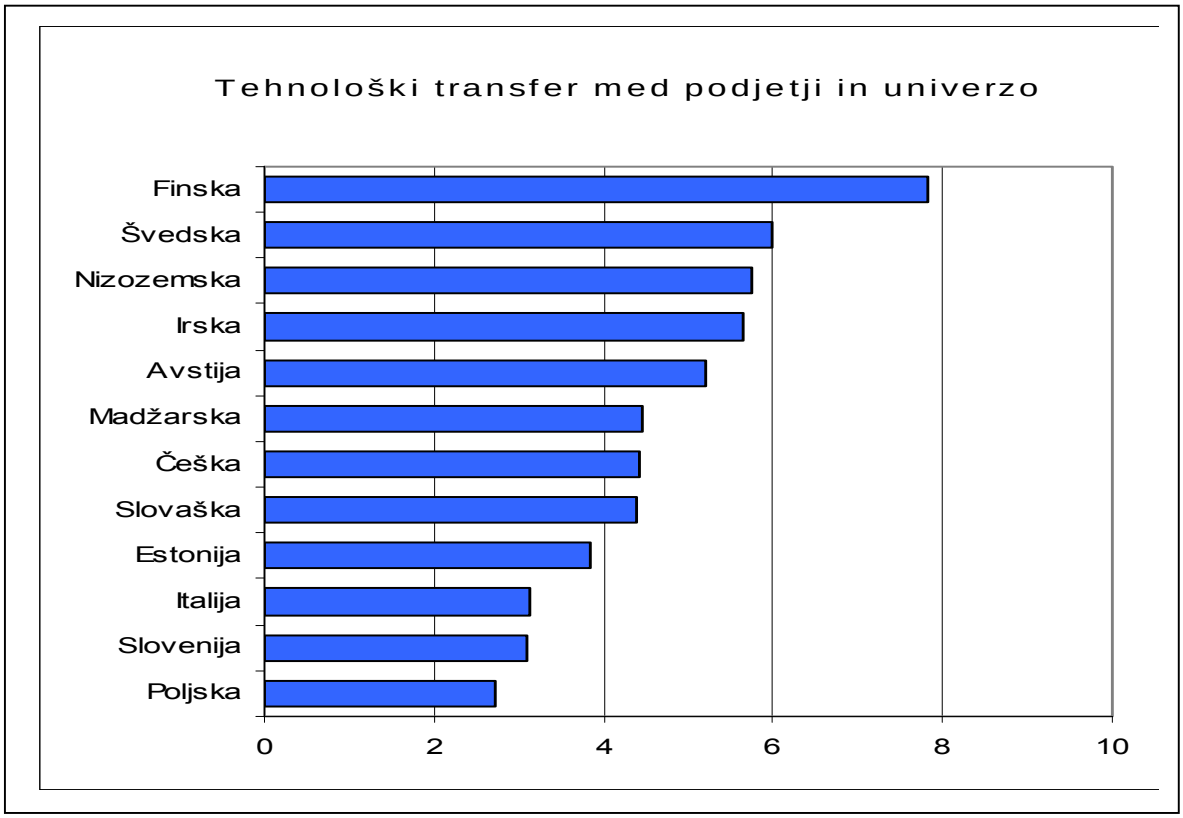

Figure 2. The role of LUI as assumed in its business plan (2003)

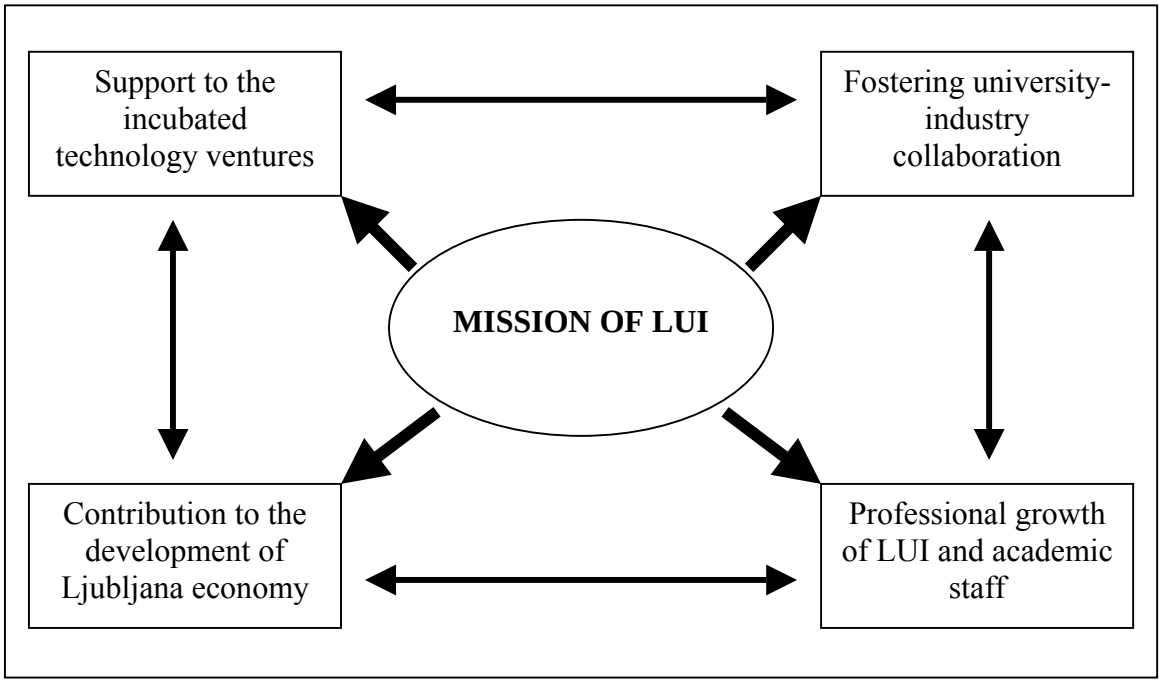

Figure 3. The vision of LUI as the focus of entrepreneurship development

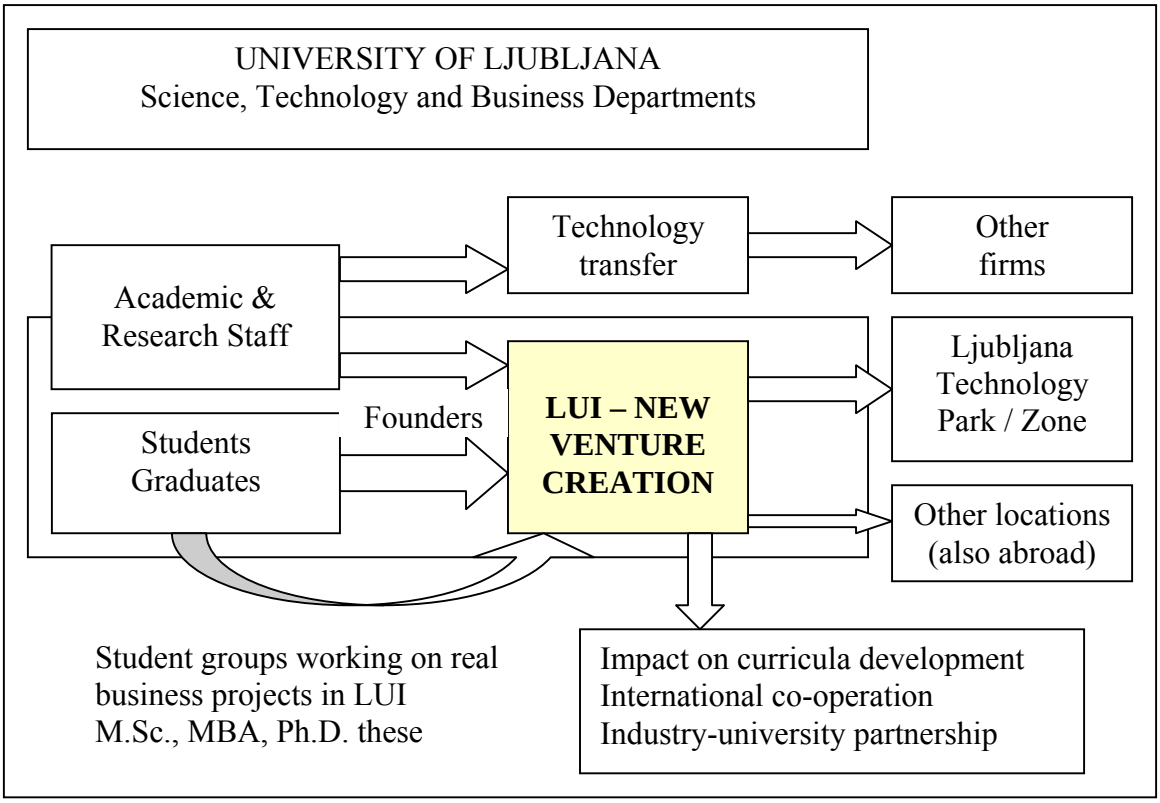

Figure 4. Organisation and network structure at LUI

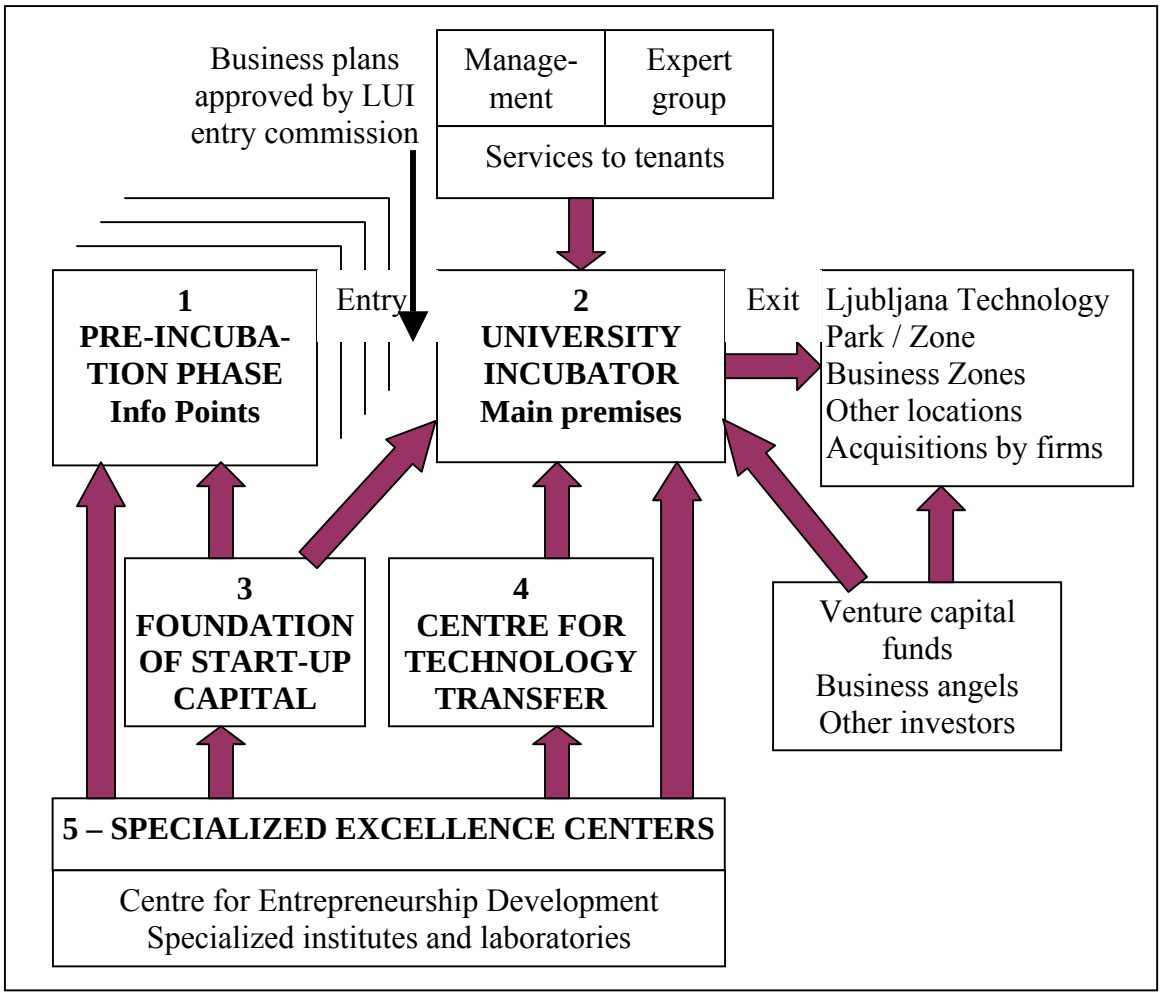

Table 2. Entrepreneurial teams at their initial stage

Project	***Short description***	***Evaluation***
SLO-IGC d.o.o. 3 members	Services: measurement of the surface energy of hard particles, measurement systems and equipment validation (pharmacy, food processing industry)	Mature business plan
KAT Systems d.o.o. 3 members	Design and production of low-budget sailboat of the catamaran type	Question: market
WIPEE – Marketing 4 members	Production of sanitary equipment and marketing of products for men restrooms	Tested, question: market
AirPRO d.o.o. 2 members	Marketing of professional process software and consultancy on energy and material-saving redesign of processes	Question: market
Surgical body implants 3 members	Production of low-budget medical implants for surgery	Question: quality
CST d.o.o. 1 member	Design and production of massive rubber parts for oil industry and bridge construction	Hardly viable
Video-control system 3 members	Design and marketing of multi-purpose video controlling systems (safety, process improvements)	Question: technology, market
VVE Consulting 3 members	Consulting to SMEs on the overall redesign of business processes based on up-to-date computer and internet technology	Viable
Skylab d.o.o. 5 members	Institute for multimedia and convergence – design and implementation of web applications and portals	Need further investigation
ECO-tire 4 members	Recycling of used tires and sales of material components	Question: market and technology
E-services 2 members	A web portal to provide exchange of various information on services available to households	Question: market
PAP Engineering 1 member	Full automation of modules of production process	Firm already founded

Entrepreneurship OR Innovation Policy: Comparative Practices in New Zealand and Sinaloa, Mexico

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ABSTRACT

This paper compares entrepreneurship and innovation policies in New Zealand and Sinaloa, Mexico. New Zealand has a robust and well-funded innovation policy yet places little emphasis on the needs of actual individual entrepreneurs and their decision to choose self-employment. In Sinaloa the emphasis is on creating more and better entrepreneurs, but there is no innovation policy. Both sides have something to learn from the other.

Using population survey data from the Global Entrepreneurship Monitor (GEM) and from in-depth interviews (Frederick et al., 2004), the paper discusses what each can learn from the other in order to create a "three-legged" foundation for prosperity, namely three interconnected policies: small business policy, innovation policy and entrepreneurship policy. Entrepreneurship and innovation are seen as complementary phenomena that go hand in hand. An innovation uncommercialised is an innovation wasted, and entrepreneurship is thus considered to be the commercialisation of innovation. A prosperous economy must get the three-legged chair of small business policy together with both innovation policy AND entrepreneurship policy.

KEYWORDS

Mexico, New Zealand, entrepreneurship, innovation, policy

INTRODUCTION

This paper compares entrepreneurship and innovation policies in two very different and, for many readers, quite unfamiliar economies, New Zealand and Sinaloa, Mexico. A prejudiced comparison, one might say, to contrast a national with a state (provincial) economy. Yet as part of an OECD study group of entrepreneurship experts and scholars who spent one week intensively studying Sinaloa, Mexico, I as a New Zealander was asked to evaluate the entrepreneurship and innovation policies of Sinaloa in the light of best practice in New Zealand. Our report *A Review of Entrepreneurship in Sinaloa* appeared in October 2004 and is available from the OECD Directorate for Employment, Labour and Social Affairs, Local Economic and Employment Development Programme (OECD 2004).

Although these "neighbours" are separated by 6,000 km of Pacific Ocean, Mexico is New Zealand's largest trading partner in Latin America. New Zealand's attention has focussed heavily on Mexico for economic reasons. Not only is Mexico's population of 100 million a huge potential economic partner in its own right, through its network of free trade agreements, Mexico has preferential access to 860 million consumers in 32 countries covering sixty percent of the world's GDP.

Like New Zealand, Mexico (and Sinaloa as part of it) is a "New World" country open to new ideas and innovation. Also like New Zealand, Mexico is known internationally for economic reforms that have created two outward-looking, world-trading, and competitive economies. With this shift, a new class of entrepreneurs arose with the support of the government. One of those regional centres of entrepreneurship, and (with New Zealand) the subject of this study, is the State of Sinaloa, with its capital city, Culiacán.

Mexico and New Zealand are near the top in the global entrepreneurial rankings. Beyond this, however, and more germane to this study, both countries are filled with low-aspiration entrepreneurs who generate low levels of wealth and have low potential for growth.

Both are dominated by micro-businesses that do not have high-value-added components and are not investment-ready and pre-qualified for risk capita.

ENTREPRENEURSHIP, INNOVATION AND ECONOMIC GROWTH

The idea that entrepreneurship, innovation and economic growth are closely and positively associated comes to us from the work of Josef Schumpeter originally written in 1911 (Schumpeter & Opie, 1936). In essence, Schumpeter separated himself from two hundred years of neo-classical economics, which had recognised only three factors of production: labour, naturalresources and capital. Knowledge, productivity, education, and intellectual capital were all regarded as externalitiesor exogenous factors– that is, falling outside the neo-classical system. Neo-classical economics with their corollaries of perfect competition had no way to explain either quantum technological change or entrepreneurial activity (Solow, 1956). The entrepreneur simply does not exist in Solow's model.

In Schumpeter's growth theory, entrepreneurs create and exploit disequilibrium and disturbances through innovation. Schumpeter calls this "creative destruction" and Aghion and Howitt have formulated a theoretical model that includes this process (Aghion & Hewitt, 1992). "New growth theory" developed in earnest in the mid 1980's through the work of Stanford economist Paul Romer and others, who have attempted to deal with the causes of long-term growth, something with which traditional economic models have had difficulty. Following Schumpeter, Romer saw knowledge and technology as an intrinsic part of the economic system (they endogenise knowledge and technology). In addition to natural resources, capital and labour, knowledge thus became a fourth production factor, a phenomenon that had become especially evident in leading economies (Romer, 1994, 1986, 1990).

Romer's theory differs from neo-classical economic theory in several important ways. Knowledge is a basic form of capital. Economic growth is driven by the accumulation of

knowledge. While traditional economics predicts that there are diminishing returns on investment, Romer sees that knowledge-driven innovation can raise the return on investment. According to Romer, the virtuous circle that results can raise an economy's growth rate permanently. Ethier (1982), Rivera-Batiz and Romer (1991) and Grossman and Helpman (1991, 1993), amongst others, have helped place this general subject in the forefront of international economic research with their path-breaking work that brought innovation-driven growth and trade into the economic model. New firms contribute to economic dynamism and growth in two ways. First, they introduce new innovations into the marketplace, contribute to a more efficient allocation and use of productive resources, and thus create greater potential for national economic growth.

Gradually governments are finding their way along the path from small business policy, through innovation policy, to entrepreneurship policy. Regardless of their diverse structures, diverse philosophical underpinnings, diverse ideologies and social goals, "governments realize the significant implications of business entry and exit and 'churn rates' and the dynamism of the small business sector for innovation and growth. . . . It will be hard for them to ignore the need for enhanced entrepreneurship support" (Lundström & Stevenson, 2001). From the literature it is clear that innovation policy and entrepreneurship policy go hand in hand. An innovation uncommercialised or unexploited is an innovation wasted. Entrepreneurship might be seen as the commercialisation of innovation. Thus a prudent government would focus on both. As we shall see, New Zealand and Sinaloa are markedly different in their respective emphasis on one or the other.

WHY ENTREPRENEURSHIP OR INNOVATION?

In both Sinaloa and New Zealand, there is a high level of government awareness of the need for economic growth. Yet, from the outside one of the biggest differences between the two is the stress put on innovation OR entrepreneurship.

New Zealand is still quite caught in "innovation-speak". From the Prime Minister down through the business chambers and the media, government policy is making the greatest effort to drive up innovation. Policy and media discourse focus on it. A huge amount of resource and expertise is going into increasing the stock of innovative ideas, products and services. In actual fact, New Zealand places little emphasis increasing the supply of entrepreneurs. Government policy does not explicit focus on the needs of actual individual entrepreneurs and their decision to choose selfemployment. Entrepreneurship has only just entered the public discourse and governmental leaders do not place great stock in it. For the left-leaning government with a strong basis in trade unionism, entrepreneurship and self-employment do not fit easily into the dominant ideology. There is no entrepreneurship policy per se, on small business policy and innovation policy.

In Sinaloa, in contrast, the word innovation is hardly mentioned. There, from the minister on down, the emphasis is on creating more andbetter entrepreneurs. In Sinaloa, there is little evidence of an "innovation system". The bottom line is that in New Zealand government policy emphasises innovation above all else while in Sinaloa entrepreneurship is the driving policy to raise the level of economic performance and to raise the standard of living for everyone.

TWO ENTREPRENEURIAL ECONOMIES CONTRASTED

New Zealand with 3.9 million and Mexico with 104.9 million are vastly different in size. About 2.4 million and 58 million, respectively, are in their working years. In New Zealand, 13.8% of working age adults is trying to launch new firms. In Mexico, 12.4% are trying to get their start-up firms off the ground.

Mexico and New Zealand are also very high in the Firm Entrepreneurial Activity (FEA) index, which measures whether existing businesses are considered entrepreneurial. In New Zealand, 16.82% of existing firms are entrepreneurial firms while in Mexico 18.8% of

existing firms are entrepreneurial firms. Table 1 provides the total population as well as estimates of the total number of individuals and business entities considered entrepreneurially active, established operating businesses, and entrepreneurial firms (those by our definition providing market innovation and hoping for growth). Table 2 shows that Mexico and New Zealand are within a 3% of one another in overall TEA and thus are amongst the most entrepreneurially ranked countries in the world. They both have high proportions of opportunity entrepreneurs. Where they differ is in the rate of necessity entrepreneurship, where the Mexican rate is high while New Zealand's is moderate-to-low.

In 2002, 40 New Zealand experts and 40 Mexican experts in the field of entrepreneurship completed extensive questionnaires. The limitation of this section is that these comments were made on Mexico in general and not on Sinaloa specifically. Yet it is clear from the in-depth interviews that we can generalise from the country to the specific State. Six significant differences are revealing:

Regulation: Mexicans suffer more regulation. Compared to New Zealand, it is harder for new firms to get most of their required permits and licenses; taxes are a burden for new and growing firms; and government regulations are not applied to new and growing firms in a predictable and consistent way.

Market openness: Mexicans suffer from a lack of openness. For Mexican entrepreneurs, new and growing firms cannot afford the cost of market entry or enter markets without being unfairly blocked by established firms. Anti-trust legislation is not effective and well enforced.

Physical infrastructure: Entrepreneurs in Mexico has less access to available physical resources – communication, utilities, transportation, land, or space.

Intellectual property: Compared to New Zealand, Mexican experts complain that Intellectual Property Rights (IPR) are not enforced; that illegal sales of 'pirated' software,

videos, CDs, and other copyrighted or trademarked products is extensive; and that inventors' rights are not respected.

Female entrepreneurs: Mexican experts believe there are insufficient social services available for women to continue to work even after they start a family. More than in New Zealand, starting a new business is not a socially acceptable career option for women.

WHAT IS AN INNOVATION SYSTEM?

Having provided a snapshot of these two countries from an entrepreneurial perspective, we now examine what is meant by innovation policy and by entrepreneurship policy.

A commonly accepted definition has it that an innovation is the result of new or recent developments or applications inscience, technology or other knowledge areas, or the result of new combinations of existing technology. An innovation does not have to be new to the market, but rather new to a firm. There are two forms of innovation: (1) Product innovation defined as new or significantly improved products (goods or services) offered by businesses to their customers; and (2) Process innovation identified as new or significantly improved production processes introduced by businesses, including new ways to supply services or deliver products (Statistics New Zealand, 2002).

How might one characterise the New Zealand innovation system? New Zealand's Minister of Research, Science and Technology has defined New Zealand's innovation system as the "aggregation of those things that contribute to a nation's ability to create or discover valuable knowledge and to deploy it widely, accurately and quickly" (Hodgson, 2002). The components of New Zealand's innovation system would include:

- Research, science and technology
- The education system
- Protection of intellectual property, and to see it as a new form of capital.

.• The immigration system
- The ability to form international strategic alliances

- A responsive Government led by visionary politicians and state servants
- Fluid capital markets
- A robust Internet infrastructure
- Creative arts, design, and engineering

- Linkages between science and society
- A Futurewatch capacity
- Basic research and public good research

An innovation system exists to drive up the supply of commercialisable innovation, inventions and ideas. It requires an excellent basic infrastructure and responds to stimuli such as grants and incentives. Governments can and should invest in innovation. New Zealand has studied innovation systems around the world and has designed one that fits its particularly circumstances.

WHAT IS ENTREPRENEURSHIP POLICY?

An entrepreneurship policy, in contrast, focuses on the human individual, not research institutes or small firms. Some factors associated with generating more entrepreneurship are not easy for the Government to control. Government cannot simply increase the percentage of young adults in the population, or raise the level of joblessness, income disparity, or unemployment (factors positively associated with the level of necessity entrepreneurship). One area where Government can assist in is increasing the supply of entrepreneurs willing, motivated, and with theproperskills to choose self-employmentand venture creation.

This is quite different from *Small Business Policy*, which aims to create favourable economic conditions and to level the playing field, and Innovation Policy, which aims to

increase the supply of commercialisable products and services. Small Business Policy means trying to adjust the R&D environment, the price signals, the finance and venture capital infrastructure and so forth. Innovation Policy funds research and development of new innovative products and services. Entrepreneurship Policy is an oft-overlooked leg of a three-legged foundation of economic development.

An economy needs an entrepreneurship policy focused on increasing the willingness and opportunity of real enterprising individuals to choose to become an entrepreneur. The focus has to be on real people—their willingness, opportunities, and skills—as much as on getting the economic conditions right.

Motivation to become an entrepreneur is largely affected by education and training, the availability of start-up capital, ease of entry into the market, whether a person is an immigrant, but also age, gender, education, regional location, employment, income level, wealth, prevalence of small firms, infrastructure endowment and history.

Skills to become an entrepreneur become available to a person through entrepreneurship education in the schools, start-up training, mentoring, and networking initiatives.

Opportunity to become an entrepreneur is based upon an individual decision as to whether self-employment is the best available career option. It is affected by incentives such as profit and economic benefits; cultural support or sanctions; whether one comes from an entrepreneurial family; the social recognition of the entrepreneur; the relative security of the social safety net; and the security of being a "manager" instead of an "employer". (Adapted from Burnett (nd), van Praag & Van Ophem (1995), and Lundström & Stevenson (2000))

As one Swedish study encapsulates it, "people must be motivated to explore entrepreneurship as an option, be able to acquire the knowledge, skills and ability to be able to pursue it, and be surrounded by the appropriate opportunity structure" (Lundström & Stevenson (2000, p. 12)) Policy intervention must take an integrated approach. That's why

the circles in Figure 1 overlap, because of the spill-over effects. We have to take into account both the environmental conditions and the individual characteristics.

EVOLUTION OF THE NEW ZEALAND INNOVATION SYSTEM

New Zealand is a good country to do business in. It has a competitive economic and business environment, a simple tax structure, low unemployment, robust growth, low inflation and no capital gains tax. New Zealand public servants have been confirmed as amongst the most honest in the world (Transparency International, 2003). Official information is largely free and accessible. Public policy debates largely take place in the open and the governmental framework is flexible enough to adjust to shocks and periodic electoral re-direction.

With population of 3.9 million and a land area about the size of the United Kingdom, New Zealand has a free trade association with Australia and a Closer Economic Partnership with Singapore. Exports total about US$ 10 billion and account for about 30% of the GDP. Exports come from dairy, meat, wood and wool as well as tourism, software and consultancy. Its four main markets are Australia, USA, UK, and Japan. Mexico is its largest Latin American trade partner.

New Zealand's economy continues to be one of the best performers in the OECD. While growth has come off its 4.4% peak of early 2003, over the past four years, economic growth has averaged over 3.5% annually. Unemployment has fallen to 4.3 percent, fourth lowest in the OECD.

Despite this rosy news, New Zealand faces an historical economic dilemma that economists sometimes call the "Argentine disease" 1, or the decline of a once prosperous economy because the country's per capita income has declined from among the highest in the world in the 1950s to just under the OECD average in 1970, to 26th in the OECD by 2004. As a result, New Zealand's leaders have long articulated a goal of returning to the top half of

the OECD. The objective of the Growth and Innovation Framework (GIF) is to return New Zealand to the top half of the OECD rankings.

Innovation is constantly cited as a key factor in sustaining economic growth capable of competing successfully on the international stage. The dominant thinking in Wellington is that driving up innovation will also drive up the economic growth rate. Government policy has put great emphasis on innovation as the key to reversing the "Argentine disease" in New Zealand. In fact, it is doing respectably albeit from a low base.

The Lord of the Rings film trilogy may have boosted New Zealand's reputation for innovation, but it reinforced what Kiwis—both indigenous Mäori as well as European New Zealanders—already knew about themselves as being "bloody innovative". Values such as resourcefulness, inventiveness, hard work and respect have always been part of what defines Kiwis—from the cow-cocky (dairy farmer) to the modern Waikato biotechnologist. It is no accident that New Zealanders were the first to climb Mt Everest and to split the atom. Sir Edmund Hillary's "We knocked the bastard off" and Sir Ernest Rutherford's "We haven't the money so we must think" are part of Kiwi innovation lore.

European settlers developed a culture of innovation that stemmed from their remoteness to sources of tools and manufactured goods. In the nineteenth century they had only a few of the tools necessary to carry on their trades as farmers and foresters. They had to be innovative or starve. They took up the challenge by modifying and adapting what little equipment could be imported from their remote homelands. The conversion of New Zealand bush into farms created the need for a lot of fences. The preferred wire was known as "Number 8 gauge", but it was also put to so many other uses that the "Number 8 wire mentality" now represents "Kiwi ingenuity," a quality that was born out of isolation and lack of infrastructure in New Zealand's early history.

Mäori, New Zealand's indigenous Polynesian inhabitants, also have a history of entrepreneurship and enterprise upon which to draw. The Mäori Wars of 1860-1866 were

fuelled not only by the settler's hunger for land but also because Mäori had become such successful entrepreneurs that they controlled a large share of the commerce throughout the country. Mäori exported to Australia and various other countries, and to some degree Mäori entrepreneurial abilities were the subject of envy by Päkeha. Mäori were also fervent adopters of technology. Best known is the Mäori use of the muskets to the great cost of the settler forces. Less well known is the history of Mäori adaptation of European agriculture and shipping methods as well as their rapid adoption of books and use of publishing.

New Zealand innovation policy has been well informed by developments in the OECD, the European Union and APEC in the fields of research and policy.2 Important policy initiatives of the present Labour-Progressive coalition government and the previous liberal National government have contributed greatly to today's Innovation Policy.3

The present government, elected in late 1999, saw that a more interventionist attitude was needed to ramp up innovation. This manifested itself in the creation in 2000 of the Science and Innovation Advisory Council to raise public esteem for science; promote a long term strategic direction for research science and technology; build private sector commitment; and co-ordinate Government policies with business and the community. Innovation thus became (with social, environmental and economic policies) one of the four major government goals.

One of the first problems was that, aside from the science and technology sectors, innovation was not a top priority. Innovation champions were few in number. SIAC also realised that what was required was culture change that takes time, effort and a lot of money. Government priorities had previously not focussed on innovation and R&D per se. Public and media attitudes were unhelpful. The public tended to prefer an expose on medical malpractice over news of a medical breakthrough. The business community was more focused on reducing compliance costs than on innovation, and the whole economy was more

focussed on tangible products such as wood and sheep than on intangible products such as software and film as the real future business drivers.

In part stimulated by the work of the Science and Innovation Advisory Council, the Government set out to design an innovation policy that was relevant to New Zealanders and capable of accelerating economic growth. Prime Minister Helen Clark articulated the government's approach to economic development in the February 2002 document Growing an Innovative New Zealand and the policy is usually referred to as the Growth and Innovation Framework, or GIF (Prime Minister Helen Clark 2002). GIF built on interventionist economic development policies that the government had put in place between 2000 and 2002, and on other public and private sector thinking about how best to lift New Zealanders' living standards.

Strengthening the innovation system

New Zealanders look at innovation as a system of interconnected organisations and institutionsthat influence the development, diffusion and use of innovations. Quite in contrast to the previous liberal National government, the Labour-Progressive coalition government recognised that it had a key role to play in supporting New Zealand's innovation system. Science and research spending is now up by 45% over the past five years, with a good proportion of it going out to the private sector.

Developing skills and talents

As many as 40% of adults do not have all of the foundation competencies needed to fully participate in a knowledge society. Driving up educational participation is essential and New Zealanders have a high rate of tertiary participation by international standards. As a remote country with a small population, New Zealand must also strike a skills balance

between education and immigration. Immigration can contribute to economic growth if migrants are able to bring skills that are not readily available.

Increasing international connection

For a country as isolated as New Zealand, international connection is essential to drive innovation, improved productivity, and economic growth. These linkages include the international flows of goods and services, people, investment, information, ideas, knowledge, technology and culture. They help the country's entrepreneurs exploit commercial opportunities, access new markets, and exploit economies of scale. They help build management expertise and give access to larger pools of skilled labour and capital.

Engaging with sectors

Groups of firms (known as clusters or industry sectors) often have issues in common that affect their opportunities for growth. Engaging with sectors enables the government to identify and tackle sector-specific problems. In May 2002, the government established four taskforces for biotechnology; information and communications technology (ICT); design; and screen production. These sectors were singled out because of their high growth potential.

If New Zealand has no entrepreneurship policy, whence do we take hope?

New Zealand has its small business policy and its innovation policy in place. But we argue for the need to pay more attention to the needs of enterprising individuals. This is the difference (or the complementarity) of innovation and entrepreneurship. Small business policy gets the economic conditions right. Innovation policy drives up the rate of commercialisable innovations. But entrepreneurship policy focuses on individual behaviour, motivation, skills and opportunity.

ENTREPRENEURSHIP POLICIES IN SINALOA, MEXICO

The author participated in an extensive qualitative, case study data collection exercise with a team of five OECD experts to examine entrepreneurship policies and achievements in the Mexican State of Sinaloa. The report A Review of Entrepreneurship in Sinaloaappeared in October 2004 and is available from the OECD (2004).

Sinaloa is one of the smaller states in Mexico occupying 58,000 km2 along the Pacific Coast. Nonetheless, it contains fully 40% of the country's entire fresh water and is lush in valleys, dams, agriculture, rivers, and diverse microclimates. Due to its immigration history, the 2.5 million inhabitants have a risk-taking spirit. Beginning with capital-intensive and perilous mining industries in the 1800s, its mixture of predominantly Spanish and other European peoples are individualistic and compete strongly with their neighbours. The turbulent weather and markets have helped them to be risk-tolerant. Being a failed entrepreneur in Sinaloa is no stigma as recessions, depressions and banking failures have delivered the levelling blow of bankruptcy to virtually everyone at one time or another.

Unlike in New Zealand, where they are the dominant discourse, the words "innovation" and "innovation policy" are rarely heard in Sinaloa. "Entrepreneurship policy" is the name of the game in Sinaloa. The state government, through the Secretariat of the Economic Development, has made a commitment to nurture and support an entrepreneurial culture and economy in the state.

Sinaloan entrepreneurship policy arose out of the crisis of the mid-nineties. For Sinaloa, the North American Free Trade Agreement (NAFTA) meant considerable economic collapse, since its industries were no longer protected. Sinaloa realised early on that neither the economic reforms of the eighties and nor the commercial opening to the United States in the nineties could were going to help it. Open to competition from more competitive firms in places such as Florida, agriculture production lost yield; food imports led to bankruptcy of

many agribusinesses. It became quickly apparent that Sinaloa had to "de-commodify" itself and to change its heavy dependence on commodity exports.

Sinaloan economic policy of present period can be summarised in four points:

- More and better jobs.
- More and better entrepreneurs.
- More and better firms.
- Add value to commodity production.

As the State Secretary of Economic Development, Heriberto Felix Guerra says:

> *We had to drive up the entrepreneurial spirit and convert Sinaloa into a land of entrepreneurs. We had to changepeople's mentalities from 'Make themgive me a job' to'Let them help me create a job'. Paternalism was the cause of our poverty. If yougive them hand-outs, they lose their dignity, theirspiritof entrepreneurship.*

In Sinaloa, a driving-sector company (empresas tractoras) is one that that drives or pushes economic activity by creating jobs, attracting investment (see Figure 2). It is also a vehicle for other companies to commercialise their own products and/or services, thereby developing themselves as local suppliers to strengthen the internal market.

The Sinaloan model goes like this: The Top 100 Sinaloan companies provide 20% of the jobs in the state while the top 500 provide 42%. Beneath them are the small and medium enterprises (SMEs) and the micro-businesses. At the base are the young entrepreneurs (Jovenes Emprendedores) who are the source of micro-enterprises. So there is a critical relationship between the Driving-sector Companies, those companies underlying them that supply goods and services, and young entrepreneurs.

Young entrepreneurs are at the base of the Sinaloan model of economic development, so education is a critical element in growth. This Jóvenes Emprendedores (Young Entrepreneurs) programme is now a requirement for 90% of undergraduate students in Sinaloa. Sinaloan officials travelled as far away as Australia and Canada searching for a system to train young entrepreneurs. They found it in their own backyard, at the Tec de

Monterrey (Instituto Technologico de Estudio Superiores de Monterrey or ITESM). Tec may have the largest undergraduate entrepreneurship programme in the world. Every undergraduate (19,000) must have "Development of Entrepreneurs" in 7th semester. There are 120 lecturers who teach this single course and there is a highly developed pedagogy to train these lecturers. Students may also choose a "Specialisation in Entrepreneurship", which means that they have to have their business up and running in order to graduate. There are the requisite incubators, business plan competitions, and capital funds to make this possible. The Jóvenes Emprendedores initiative is unprecedented at the tertiary level in Sinaloa, but at the global level as well. It underlies a strong commitment towards creation of an entrepreneurial culture in the State of Sinaloa.

Here we described some of the important entrepreneurship policy initiatives that are described in greater detail elsewhere (see OECD, 2004).

Regulatory Reform

Through its Law on Enterprise Management and the Regulatory Reform (Ley de Gestión Empresarial y Reforma Regulatoria), the State of Sinaloa is one of the leaders amongst the states in streamlining regulations and formalities from multiple regulators and layers of government, which all acknowledged have greatly slowed down business responsiveness, hampered market entry, reduced innovation and job creation, promoted the informal economy and corruption, and generally discouraged entrepreneurship. The importance to entrepreneurs of this simplification in administrative proceedings cannot be overemphasised. It used to take months to start a new company. Now the processes typically takes less than eight hours, making Sinaloa one of the leading States legislating on enterprise management, speedy firm creation, use of the Internet, and the recognition of electronic signatures.

Finance mechanisms

Fondo Sinaloa de Fomento Empresarial (Red FOSIN), the Sinaloan Fund for Enterprise Development Network, is a network of "one-stop shops" for financial services. The network provides micro- and SMEs with needs assessment, training, assistance with business planning, access to financing, linkages with business partners and opportunities, and continued followup with the entrepreneur. FOSIN Advances (FOSIN Avanza) works at a higher level, with loan sizes ranging from $500,000 - $4,500,000 pesos. FOSIN Woman (FOSIN Mujer) is a new micro- and SME financing project with capital of 2 million pesos and loans ranging from $20,000 - $50,000 pesos. FOSIN Emprende, with $2 million pesos in capital, is connected with the university entrepreneurship program and targets microenterprises in the start-up phase with loans between $20,000-$50,000 pesos.

Mi Tienda

Mi Tienda is a program of the government of Sinaloa that provides business development services and small loans to owners of so-called "abarrotes." Abarrotes are very small grocery stores found in just about every neighbourhood or village in Mexico ("dairies" in New Zealand). Abarrotes are family-owned and operated. Mi Tienda is a component of a larger economic development plan by the government of Sinaloa to promote entrepreneurship. Although a single abarrote by itself not significant, in the aggregate they form an important sector of the Sinaloan (and Mexican) economy. Abarrotes moreover, purchase a high percentage of inventory from local producers, such that in the aggregate they comprise a large and vital component of demand for locally produced goods.

The Prosper Foundation

Fundación Prospera (Prosper Foundation) is a group of socially conscious entrepreneurs motivated by the desire to use private sector principles to solve social problems

in the state. The mission of the Prosper Foundation is to "raise the quality of personal and community lives of foundation participants, create an entrepreneurial culture, and promote investment in high-quality projects through (a) micro-credit and savings schemes and (b) capacity building and technical assistance to small business owners." All clients of the Prosper Foundation are micro-entrepreneurs. The typical client lives in a larger city; is self-employed; is a woman (70% of clients); runs a family-based business in the industry, service, or commerce sectors; and does not keep written accounts. Foundation officials estimate that 60% of clients are poor.

DISCUSSION

One of the biggest differences between the two economies is the stress put on innovation OR entrepreneurship. New Zealand is still quite caught in "innovation-speak". From the Prime Minister down through the business chambers, the greatest effort is made to drive up innovation. Policy and media discourse focus on it. In contrast, the word innovation is hardly mentioned in Sinaloa. There from the minister on down the emphasis in on creating more and better entrepreneurs. Every campaign, every slogan, every government programme focuses on entrepreneurship and takes innovation as a given.

This is perhaps the bottom line that differentiates the two countries. In New Zealand, government policy emphasise innovation above all else. In Sinaloa, entrepreneurship is the driving policy to raise the level of economic performance and to raise the standard of living for everyone.

NEW ZEALAND LESSONS FOR SINALOA

A Google search for "innovacion en Sinaloa" turns up just one document while a search for "emprendedores AND sinaloa" reveals more than six hundred. While both New Zealand and Sinaloa need to drive up their respective living standards, it is clear that they

have chosen two differing ways of doing so. New Zealand has focused its efforts on innovation while Sinaloa emphasises entrepreneurship. While the OECD study panel was impressed at the size and scope of the entrepreneurship policies in the State of Sinaloa, it expressed its concern that these policies were not interconnected with a clearly stated policy on how to accelerate the rate of innovation in the State. In addition to robust entrepreneurshipand small business policies, Sinaloa needs an innovation policyfocused on ramping up the number of commercialisable products and services.

New Zealand has an ever-increasing supply of new services and products that could be attract to the global marketplace, yet its supply of entrepreneurs cannot keep the pace. Meanwhile, research & development is very low in Sinaloa due to barriers to innovation. These barriers include protectionism, barriers to trade, low levels of education and so forth. Sinaloa cannot rely on business to fund innovation since the market has several defects in relation to innovation. The free market system in Sinaloa simply does not produce sufficient innovation. That is why the entrepreneurs in Sinaloa need extra-market institutions to reduce the inherent flaws in private sector innovation development. This of course includes the education system which generates Human Capital. It also includes government programmes to fund private innovation and to protect intellectual property rights. It embraces as well the development of high-quality ICT networks, universities and research institutes. Coordination amongst the key partners is essential. A Sinaloan Innovation System is an essential element in the economic growth strategy. Not only does the State need more and better entrepreneurs; these entrepreneurs need more and better innovative products and services to take to the market.

We could say that Sinaloa suffers from a dysfunctional innovation system. Universities absorb huge quantities of resources and do not produce the kinds of products and services that are relevant to entrepreneurs. Nor do universities have a strong connection with business such that entrepreneurs can quickly take innovations to the marketplace.

Universities do not have a pricing motivation that ensures cooperation with the private sector. There are information asymmetries and it is difficult to monitor contract fulfillment. Coordination between research institutes and the private sector is lacking.

Drawing upon the New Zealand experience, Sinaloa must cross the tipping point from entrepreneurship to innovation. Key initiatives to increase the speed of innovation development should include:

- Strategic research to improve the competitiveness of Sinaloan industries
- Research projects co-ordinated by funded research institutes with sector participation
- Support for students and researchers to carry out R&D within companies
- Long-term funding for research institutes
- An Innovation Policy Advisory Board to engage with business and community partners
- Trade promotional activities to help Sinaloans bring their products to international markets
- Funding to boost efforts to attract high quality investment to Sinaloa
- Support for networks with leading global businesses
- Acceleration of clusters to tackle state-sector-specific problems. Private
- An inventory of transport, energy, telecommunications and water infrastructure
- R&D projects to enable firms to develop high-value, technology-based and export-oriented products, processes or services
- Subsidies to support the placement of researchers or technologists in firms to build linkages and enhance understanding of technological innovation in a commercial environment

It is clear that the Sinaloan government is committed to transforming its economy and society into one that is prosperous, sustainable, socially inclusive, knowledge-based, and innovative.

The State has developed an entrepreneurship policy of which it can be proud and which can serve as a strategic beacon for other countries. Yet it is clear that Sinaloa has a great need to raise the importance of other aspects of its economy and society to complement its excellent entrepreneurship policy. These are the "New Zealand lessons for Sinaloa": that innovation policy can help gear the economy for growth. Unless a Sinaloan Innovation System is stimulated, it will have major problems. Turning the corner from entrepreneurship policy to include a strong innovation policy seems to be the logical next step for a prudent and progressive government.

MEXICAN LESSONS FOR NEW ZEALAND

Compared to Sinaloa, in New Zealand there has been little movement on promoting a government policy to increase the supply of entrepreneurs. The political parties have no policy directly addressing entrepreneurs. Neither the private nor public sector supports entrepreneurship benchmarking research. Even entrepreneurs themselves are too busy to advocate for a lobbying group.

Based on the Sinaloan experience, it is clear that New Zealand needs to stimulate the economic and social environment so that enterprising New Zealanders can raise their game, develop and add value to their innovations for the benefit of the country as a whole. Sinaloan entrepreneurship policy shows that it is possible to foster favourable conditions in which working people can create prosperity through sustainable growth-oriented businesses. New Zealand needs to create supportive and opportunistic environments for potential entrepreneurs to acquire resources and to assist these resourceful people gain those essential skills through the school system, via start-up training, mentoring, and other initiatives. It needs to create

incentives, provide cultural support and social recognition for people who want, and can, create workplace settings for others.

True entrepreneurs are people who habitually create and innovate to build something of recognised value around perceived opportunities (Bolton & Thompson, 2000). Yet New Zealand's entrepreneurs are not creating enough new wealth. Joe and Jill Entrepreneur typically operate a 6-person lifestyle firm in the Auckland area servicing the internal market. They are not the kind of export-oriented, dynamic firm that can exploit innovative venture opportunities and increase the size of the cake. They would rather exploit existing equilibrium opportunities and optimise supply and demand in established markets rather than exploit innovative venture opportunities and create new markets at home and abroad.

From this comparative analysis, it is clear that current New Zealand government policy represents two legs of a three-legged chair: Get the macro-economic conditions right and then introduce new resources and technologies for innovation. Yet it pays no heed to real people who would like to choose self-employment, create wealth on behalf of all, and commercialise innovations. The problem is that an innovation uncommercialised is an innovation wasted, and entrepreneurs are the people who exploit innovation. But true entrepreneurs are a very scarce resource.

How to increase the supply of true entrepreneurs? Based on the Sinaloan experience of entrepreneurship policy together with other international best practices, there are three areas which, in enacted, would show that entrepreneurship policy is being taken seriously in New Zealand.

A National Commission on Entrepreneurship provides policy makers and leaders with roadmap of how to sustain and expand a flourishing entrepreneurial economy, focuses public policy on the role of entrepreneurship in the national economy and articulates policies that will foster its continued growth. The Speech from the Throne (annual "state of the nation") makes statements about entrepreneurship. Acts of Parliament provide specific authorities for

entrepreneurship policy focus. The Government might wish to issue a White Paper on Entrepreneurship Policy. The annual budget establishes Entrepreneurship policy with stated objectives and designates budget for policy measures.

GEM research shows that New Zealand ranks poorly (with most of the rest of the world) in primary and secondary schools providing adequate attention to entrepreneurship and new venture creation. Only the USA and Canada stand out in teaching entrepreneurship to young students. Nor are New Zealand universities and polytechnics giving adequate attention to entrepreneurship courses and programmes. They are mostly focused on creating good managers rather than employers (Frederick et al., 2002).

Universities need to come together in the areas of entrepreneurship and commercialisation. The goal is to identify ways to work together and attract government funding to build the capabilities of each of the universities in these areas. Entrepreneurship education in Sinaloa has experienced tremendous growth, yet in New Zealand only one tertiary offers a postgraduate entrepreneurship programme. Entrepreneurship education is different from management education just as business entry is different than business management. Entrepreneurship education includes training in negotiating, leading high-growth companies, new product development, opportunity analysis, and commercialisation of technologies, creative thinking and the challenges associated with venture development. We must train employers not employees. New Zealand's public and private sectors need to recognise entrepreneurs through award programs, through young entrepreneurs organizations and through a campaign to persuade more young people to consider starting a business.

Just as Sinaloa targets corner store owners, students, women, and micro-businesses, it would be strategic for New Zealand to target youth and ethnicities in order to stimulate higher levels of entrepreneurial activity within them. In particular, women must be encouraged to pursue the dream of running a business. Evidence of targeting would be resource centres, award programs, and entrepreneurial networks by demographic category.

CONCLUSION

This paper compares two very different economies, New Zealand and the State of Sinaloa in Mexico. Although they are separated by 6,000 km of Pacific Ocean and have vastly different populations, both are known for liberal economic reforms and competitive orientations. Both have a high level of entrepreneurial activity, but both are also filled with low-aspiration entrepreneurs and low wealth-creating micro-businesses.

From a comparative policy perspective, New Zealand emphasises innovation to the exclusion of entrepreneurship, while Sinaloa does just the reverse. Both sides have something to learn from the other.

The size and scope of entrepreneurship policies in the State of Sinaloa is impressive. But it also needs an innovation policyfocused on ramping up the number of commercialisable products and services. It must turn the corner on entrepreneurship policy and greatly accelerate its innovation policy.

In contrast, New Zealand has no policy to increase the supply of entrepreneurs. It is clear that New Zealand must change the economic and social environment so that enterprising New Zealanders can raise their game, develop and add value to their innovations for the benefit of the country as a whole.

If one considers a sound foundation for economic development might be represented by the humble three-legged chair, then there are three policies that make up that foundation: Small business policy, innovation policy, and entrepreneurship policy. From this comparative analysis, Sinaloa and New Zealand operate with a wobbly two-legged foundation. Both have a robust small business policy in place to even the playing field and to get the factor conditions right for business. While New Zealand the macro-economic conditions right and then introduce new resources and technologies for innovation, it does not focus on real people who would like to choose self-employment. Similarly, while Sinaloa has made huge strides in getting the conditions right for business and in promoting

entrepreneurship, without a concerted effort to increase the level of innovation, its entrepreneurs are going to have an even playing field but no innovations to take to the market.

Entrepreneurship and innovation are seen as complementary phenomena that must go hand in hand. An innovation uncommercialised is an innovation wasted, and entrepreneurship is thus considered to be the commercialisation of innovation. A prosperous economy must get the three-legged chair of small business policy together with both innovation policy AND entrepreneurship policy. Only then will the foundation for growth be sound.

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FIGURES

Table 1 New Zealand and Mexico Comparison

NAME	NEW ZEALAND	MEXICO
Data	2002-2003	2002
Total Population: 2003	3,951,307	104,907,991
Total Population 18-64 Years Old: 2003	2,464,399	58,634,254
TEA Rate [2002-2003]	13.8	12.4
Number of Persons Involved in Start-ups	340,110	7,270,079
Number of Startup Firms	179,159	3,905,636
Number of ownermanagers of Existing Firms	521,796	8,697,117
Number of Existing Firms	273,665	4,694,624
Number Owner-Managers of Entrepreneurial Firms	90,378	1,450,761
Number of Entrepreneurial Firms	46,036	880,485
Entrepreneurial firms per 18-64 Years Old	1.87%	1.50%
Entrepreneurial Firms per Total Firms	16.82%	18.76%

Table 2 New Zealand and Mexico, 2001-2003, Total Entrepreneurial Activity, % of the adult population

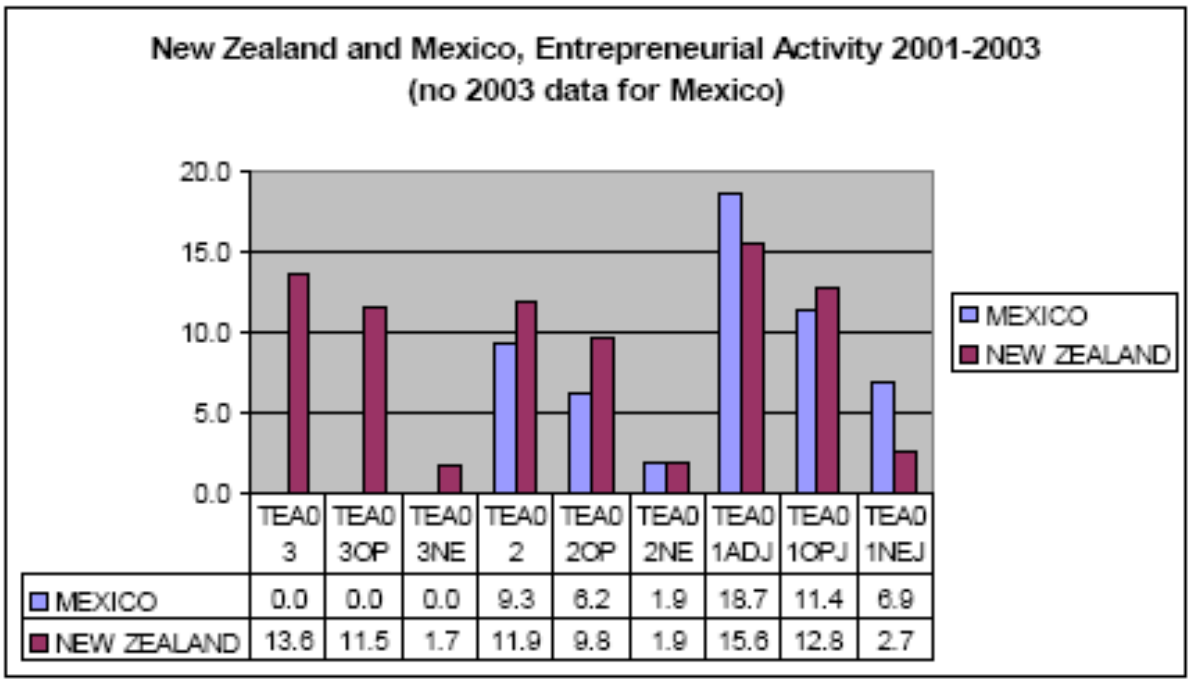


Figure 1: Entrepreneurship policy creation model

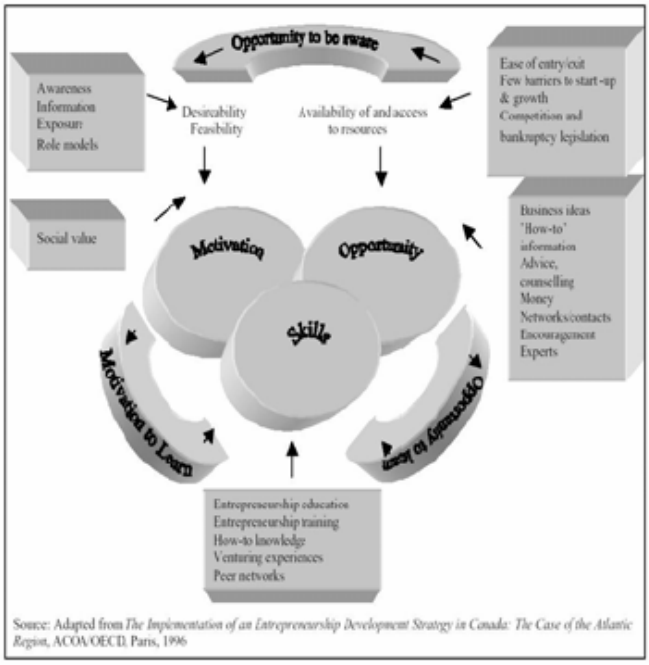
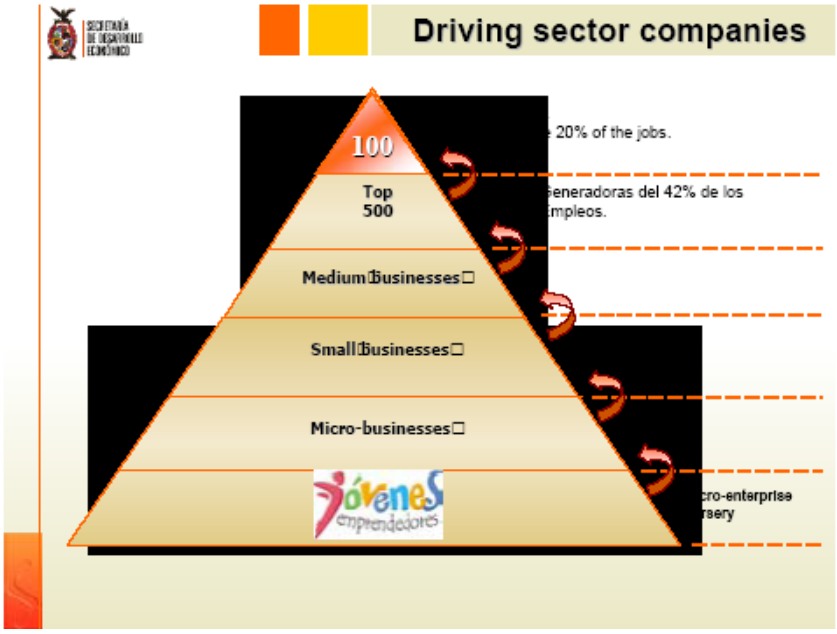


Figure 2: Driving Sector Companies in Sinaloa



[1] Although these days Argentina is considered to be a developing country, in 1929 it was as rich as any large country in Europe.

[2] See especially APEC Economic Committee (1999); European Commission (1998); European Commission (2000); Stevenson (1996);
Lundström & Stevenson (2001); OECD (1995); and OECD (2001).

[3] See for example Ministry of Research, Science and Technology (1999); Information Technology Advisory Committee (1999); Science and Innovation Advisory Council (2001); Prime Minister Helen Clark (2002); Knuckey et al. (2002).

Lessons Learned from a High Technology Start-up

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Summary

This paper describes the lifespan of a start-up e-fulfillment service provider for market leading retailers and manufacturers that adopted a first to market strategy based on a high technology business model. The company was founded by an international group of investors with substantial technology experience and networks in Silicon Valley, other "technology hot spots", and academia. It was built to provide comprehensive information technology, distribution, and customer response services for market leading retailers and manufacturers. It was capitalized with over $320 million in seed capital; chaired by one of the major contributors to the Fisher College of Business Entrepreneurship Center at the nearby Ohio State University; employed "best in class" hardware and software; and was hired by international high-end, brand sensitive clients. Despite operational successes, the company was dissolved at the end of 2003. The paper will review the lessons learned during the company's 5-year life and the potential relevance of these experiences to other technology/knowledge-based start-up ventures.

Business Strategy

In the late 1990s existing low technology fulfillment and customer service solutions were considered inadequate to meet the high velocity and rapidly growing business volumes of online retailers for the service levels, quality, and speed of delivery demanded by online customers. Existing capabilities had been built either to support catalogue sales or to replenish traditional brick and mortar retailer inventories. These capabilities were labor intense and relatively unsophisticated operations and the industry was fragmented.

Sales and revenue projections for online retailers were increasing at an exponential rate and, with the exception of fulfillment and customer service functions, barriers to entry were relatively low. By providing a high technology, comprehensive infrastructure for online retailers that provided a quick, adaptable, inexpensive solution for fulfillment and customer service, this last barrier could be removed and online retailers could focus on core functions such as merchandising, marketing, and sales. Such a capability would also stimulate additional growth from new online entrants that had a way to address the last barriers to entry.

SODC was built to fill this growing industry niche. The strategy was straightforward:

1) Build out a high tech infrastructure as fast as possible using state of the art hardware and software that would be expensive and disruptive for existing business models and new entrants to replicate.
2) Rapidly attract a critical mass of high brand sensitive clients to cover costs and provide a cash flow to support additional infrastructure growth. High brand sensitive clients were targeted because the price points of their products increased the value of each order and increased contribution margins. Additionally, market research evidenced that highly brand sensitive clients had an affluent customer

base short on discretionary time, intolerant of delays, and willing to use online retailers to bypass traditional channels.

3) Reinvest in further rapid build out to capture an increasing market share in a growing industry. The underlying philosophy was:
    a. High technology would foster high productivity.
    b. High productivity would lead to lower unit costs.
    c. Lower unit costs would attract increased volumes of business.
    d. Higher volumes of business would produce higher gross profits.

Company Overview

Founded in May of 1999, SODC was the first company of its kind to offer a comprehensive, integrated platform for businesses that included IT, technology integration, customer response management, brand management, fulfillment, and logistics management. Designed from the ground up to meet the needs of businesses moving products through multiple channels, SODC provided its clients with a major competitive advantage by ensuring total integration of all business-critical operations. While other companies adapted legacy systems to offer fulfillment services, only SODC delivered a complete system that encompassed all points of customer contact.

The company was built on innovation, vision and a commitment to excellence. In fact, it was a pioneer in the design, development and implementation of state-of-the-art technology, facilities automation and best practices that supported the customer services and distribution needs of a variety of retailers and cataloguers.

Its ultimate mission was to be the leading provider of outsourced and consulting solutions for multi-channel retailers, manufacturers, and distributors. It accomplished this by leveraging state of the art infrastructure and business practices that were developed and refined based on experience with leading global brand named companies.

The Business Model

Key Processes

SODC was able to handle all inbound customer transactions in one of its two customer response centers (Melbourne, FL and Columbus, OH). In these two centers, it handled phone, web, catalog, email and fax orders in the manner that our clients outlined. Each client could tailor its protocols to meet the client's unique customer requirements. The company became an extension of each client's organization through a combination of training and systems support. To the end user, the client's customer, this interaction was entirely seamless and it was their belief that they were dealing directly with a client representative – not an outsource service provider.

Once an order was received, it was transmitted to one of two distribution centers located in Memphis, TN and Columbus, OH for processing. The company consistently beat customer and client expectations for the timely processing of orders. For instance, all ground orders received in the company's system by 6 AM would be shipped the same day – something very few of the company's competitors can achieve to this day. And, more impressively, SODC was able to ship all expedited orders received in its system by 2 PM on the same day as well.

Brand Management

The one thing that allowed SODC to create loyal and committed partnerships with clients was the level of service and support clients received across the organization. While competitors all offered some level of account management, SODC took it to a higher level and provided a true business consultant relationship with internal advocates for every client.

Each client was assigned a primary point of contact from the Brand Management team. This team member ensured that all client needs and concerns were addressed. To accomplish this

seamless focus on each client's brand, the Brand team worked with the other functional areas of SODC to ensure that there were always open lines of communication and proper focus was provided on key issues.

Information Technology

The company developed a patent pending integrated "middleware" solution that brought together, in a creative hub and spoke architecture, a host of "best of breed" solutions. The architecture of the system allowed for most processes, including inventory updates, to be handled in real time. Orders could literally be ready to pick in the distribution center within one hour of placement on the website.

The SODC Electronic Commerce Outsourcing System

- Integrated all distribution channels
    - Web, catalog, call center (phone), brick and mortar
- $50 million technology investment
    - Software, hardware platform, client integration, catalog / web / distribution / data warehouse capabilities.
- Flexibility to link to disparate client systems
    - Integrated to customer environments
- Scalable to 500,000 transactions daily
    - Unrestricted order sizes, products, inventory or special processes.
- Ability to manage the customer relationship
    - Real-time throughout the shopping experience: item selection, order / payment processing, and product delivery.

Customer Relationship Management

SODC Customer Response: State of the art systems and people converging to create an exceptional Customer Experience. Over 800-seat capacity in two states provide the environment to differentiate SODC client's brands from the rest.

Information at the touch of a button: Siebel CRM provided full visibility of customer history (orders, inquiries, contacts) across all channels from one source.

Increased Sales: Cross-sell and up-sell functionality provided key information to help SODC analyze business trends and develop programs to help increase client sales.

Customers for Life: Captured customer specific information: how often they shopped, what they purchased, how many children they had, etc. This enabled SODC to develop more personal relationships with the client's customers that increased their BRAND LOYALTY and ultimately raised their LIFETIME VALUE to each client.

Brand Ownership: was demonstrated by SODC associates and reinforced through brand specific training and a sophisticated automated desktop coaching system.

Quality Management: the SODC quality-monitoring program was flexible and provided proactive improvement and development of associates as well as brand specific coaching.

Distribution Centers

"Best in Class" Warehouse Management System, automated material handling systems, and over 1.2 million square feet of highly automated distribution capability located at two centers in two states facilitated the expeditious receipt of client products, highly accurate inventory management, and the precise and efficient shipment of multiple items per order.

Distribution Centers were located to service more than 76% of the US population within 3 business days via ground transportation. SODC distribution centers were fully integrated, high velocity pick, pack and ship facilities that allowed individual products to be pulled from

inventory in real time, consolidated into orders, packed and sent on their way. More than 99 percent of orders were shipped within 24 hours from the time they were received. The company's warehouse management system was totally and seamlessly integrated with its customer response, order management, and data base software. The company utilized individual unit wave picking and automated conveyor and sorting technology. It was proficient at combining automated material-handling equipment with appropriate manual operations; this combination provided flexible, product-specific functionality that exceeded service levels specified by SODC clients.

As a result, client Capital Expenditure investments were minimized, labor costs were amortized across clients, rapid and accurate inventory and material management practices increased the velocity of product flow, increased inventory turns, reduced client inventory investments, improved client ROI, and increased client cash flows. Additionally, value added services such as gift-wrap, promotional samples and hazardous goods helped clients increase revenues and lower costs.

Near-real-time inventory updates – Each client had the ability to check inventory levels in a 15-minute snapshot. This allowed clients to more accurately manage their supply chains and merchandising programs.

Real-time data transfers – Client's were able to receive customer information as soon as it was created, instead of waiting for in batch mode processing. This feature enabled clients and their customers to process orders more frequently and with greater accuracy.

Distribution Center Services:

- Receiving
- Inventory Management
- Pick, Pack, and Ship

- Value-added Services
- Gift wrap, gift cards
- Promotional inserts
- Kitting
- Returns Management

Accomplishments

During its lifespan, SODC integrated a large, multi-state workforce with process improvements and best-in-class technology/infrastructure to provide scalable distribution, inventory, returns, and customer relationship services. It attained annual client sales of $400 million by leveraging its operations to minimize client capital investments and operational expenses, increase client cash flows, and improve customer satisfaction throughout the on-line buying experience (from order entry to product delivery). Company wide productivity increased 400%, same day shipping rates to were raised to 100%, inventory accuracy reached 99%, costs decreased 62%,and revenues per associate increased 400%.

What Went Wrong?

Why did a company with an entrepreneurial drive, hundreds of millions of dollars in funding, such powerful technology, thousands of highly talented and motivated colleagues, receptive business environments and huge economic incentives in every taxing jurisdiction in which it worked, and a huge pool of potential "deep pocket" customers not succeed?

Unlike the majority of its dot-com clients, SODC had a viable business model and business plan. However, it was dependent on the success of dot-coms and that success was ultimately dependent upon the sophistication and discipline of dot-com businesses, particularly as it related to their supply chain and financial viability. Furthermore, the build out and

management hubris regarding the complexity of operational integration of systems within SODC and with client systems and supply chains resulted in the consumption of initial cash resources at a rate that could not support an ongoing business without the infusion of new capital and/or a significant growth in client revenues.

Consequently the melt down of dot-coms had a major impact on SODC's business. Existing clients and potential clients went out of business and new entrants to the online marketplace disappeared. The company's capacity grossly exceeded demand, almost overnight. Exacerbating this situation was increased client dissatisfaction with SODC performance not meeting commitments and expectations. To retain clients, pricing concessions were granted and increased costs were incurred. The company was consuming its cash at an accelerated rate and financing for any business even remotely associated with dot-coms virtually disappeared.

Since projected revenue streams diminished radically and the additional financing needed to sustain the business was unavailable, the company initiated a "sale lease back" of key technology assts, began rightsizing the business, reduced capital expenditures to maintenance vice growth levels. It was at this point that the company entered the second stage of its lifecycle with a refocused strategy and new leadership.

The potential client pool was expanded to include multi-channel retailers, manufacturers, traditional with high velocity, high unit price products. The pipeline was filled with high-end shoe, auto accessory, sporting equipment, cosmetics, clothing, pet supply, and cooking ware retailers. The strategy was particularly successful with traditional "brick and mortar" retailers because they had become cautious about the potential of online sales opportunities but didn't want to reject it entirely. So, the SODC solution that enabled them to maintain an online

presence with minimum capital expenditure and shared operating expenses provided an ideal solution. Winning new business led to further price concessions. Basic services were offered at commodity prices and put additional pressure on revenues and profitability. Cash flows were still negative. However, a sustained and successful turnaround efforts improved operational proficiency and reduced costs. Together with concurrent marketing successes, profitability and positive cash flows were imminent.

All that changed on 11 September 2001 and SODC entered the third stage of its lifecycle as the entire retailing industry in the United States came to an unexpected and abrupt standstill – literally overnight. Faced with the immediate decline in client sales and the immediate cessation of all "outsourcing" initiatives by potential clients, the company implemented a survival strategy. Since it needed a critical mass of clients within six months to remain a viable business, it began a vigorous pursuit of merger and/or acquisition opportunities. It was an approach supported by the investors who committed to additional funding for the company if the initiative was successful.

Several merger and acquisition were pursued. Three were nearly successful but none were consummated.

Ironically, the operational proficiency, productivity, and cost reduction efforts of the company reached the highest levels ever achieved by SODC. Clients lauded the proficiency and capabilities of the company. Clients benchmarked SODC service offerings and service levels against competitors and determined SODC to be "best in class".

However, cash was being depleted at the rate of $3 million per month and the board agreed with management's recommendation that it was time to cease operations and sell the

business, unless a "white knight" could be found before operations were irrevocably terminated.

At this point, the company entered the fourth and final stage of its lifecycle. The investors agreed to a threefold strategy that:

1) Provided remaining clients a "soft landing" by continuing to support three months of operations while they identified and transitioned to new service providers.
2) Provided a "soft landing" for employees – ensuring they had both financial and outplacement assistance finding new jobs.
3) Return as much cash and value to the investors as possible, without filing for bankruptcy.

Concurrent with the first three months of implementing this strategy, management was to continue pursuing all viable merger opportunities.

In the summer of 2002, operations came to a close without the prospect of a merger. All clients had been successfully supported at the highest service levels. All employees were placed in new positions. Return of leased assets, sale of owned assets, and negotiations with creditors began in earnest.

It was during this last phase of the company's life that the greatest degree of insight into its construction was obtained. Facilities were constructed swiftly and expediency prevailed in equipment selection and assembly. Premium prices had been paid for assets and software in order to expedite the company's build out. In some case computer equipment and software was never fully deployed or even used. Cash was spent indiscriminately – in some cases foolishly. Cash constraints led to sale-leaseback agreements with excessive terms and

conditions – often bordering on usury. Accountability and disciplined management was a lower priority than the build out.

Facing long-term liabilities of $100 million, but wanting to maximize the proceeds from sale of company owned Distribution Center assets with a book value of $60 million and assignable software licenses, the board approved a dissolution strategy that focused on maximum investor value while avoiding bankruptcy for as long as it made good business sense. By early 2004, the $100 million of liabilities had been settled for less than $8 million.

Concurrent with liability negotiations, the company negotiated the sale of "substantially all the assets of the company". A key component of the negotiation was the ability to transfer software licenses to the buyer. It was a component of the negotiation that added significantly to the sales value. While negotiations were complicated by the unprecedented over abundance of unused distribution facilities and assets that resulted from the dot-com meltdown and a lethargic economy, SODC facilities and assets were newer and in better condition, more centrally located, and more comprehensively integrated. SODC's sale provided a one-stop shop that, unlike other possibilities, included assignable software licenses for sophisticated software systems that were already fully integrated and tested. Negotiations were also complicated by the required participation of landlords and software companies.

In the summer of 2003, negotiations with the buyer irrevocably ended.

At this point, the emphasis shifted from an integrated systems sale of the assets in both company distribution centers to the piecemeal disassembly and sale of assets from one distribution center while attempting sell the remaining distribution center intact (together with the assignable software licenses).

Ironically, when disassembly of the first distribution center reach the point of no return, basic supply and demand dynamics resulted in a significant increase in interest for the remaining integrated asset. At least ten potential buyers engaged in varying levels of negotiation to purchase the second distribution center. However, economic uncertainty, buyer board approval delays, the completion of disassembly of the first distribution center, and the continuing depletion of cash made disassembly of the final distribution center the only viable economic alternative.

By the spring of 2004 the last strategic objective of the board, that of maximizing investor value, had been accomplished:

- Approximately $100 million of creditors claims, including long-term real property lease obligations, were settled for less than $8 million.
- All personal property assets were sold for approximately $10 million.
- The company was dissolved and bankruptcy was avoided.

Lessons Learned

The key lessons from this experience have relevance to any business but most particularly to other technology/knowledge-based start-up ventures that presume a new "idea" or technology is the sufficient ingredient for a successful business – they may be necessary components of a successful business but they are not sufficient. What is needed is recognition of the following:

1) Cash is a resource that requires highly disciplined and effective management. It is the lifeblood of the business. Systemic overspending, for whatever reason, weakens the business and jeopardizes its ability to survive bad time – and bad times are a certainty.

2) Basic business practices and disciplines are more important than any idea or technology.
3) Technology is an enabler. Overly sophisticated technology not only unnecessarily depletes cash but also adds unnecessary complexity and constraints to a business model.
4) Operational proficiency and integration of technology, people, and supply chains are imperative to customer satisfaction. Knowing how much technology is needed to support a business and how to use it is more important than "state of the art" capabilities.
5) Expansion before business operations are solidified, mastered, and properly scaled is risky, both from a cash flow/financial perspective and from the perspective of meeting customer expectations.
6) Macro events like the dot-com meltdown, economic slowdowns, and events such as 11 September 2001 are beyond the control of any business and can have a huge impact of a company's future. Prudent business management, strategic flexibility and adaptability, expeditious and aggressive leadership, and pragmatic creativity enhance survivability and provide a strong foundation for future growth.
7) Being honest, fair, and inclusive with colleagues increases the likelihood of success and builds a cohesiveness that can weather the most devastating circumstances.
8) Good, talented, highly motivated people sometimes get on the wrong train and good ideas and business model are periodically ahead of their time. But strong leadership and business proficiency produce successful results no matter what stage of its lifecycle a business is in.

Co-operations of Spin-off Firms from the University of Bonn

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1. INTRODUCTION

University based spin-off firms have long been both subject to scientific investigations and part of economic policy programs. Generally spoken there are two main thoughts behind the promotion of academic spin-off prozesses: On the one hand it is the rather simple guess, that Universities create knowledge about new technologies, techniques or methods, that is applicable as an economic basis for private enterprises. On the other hand and from a rather long term perspective, academic spin-off firms with business fields to be derived from this knowledge are most likely to be involved in innovative market branches, the so called future-technologies (Knecht, 1997).Though it has to be mentioned that there is no absolut agreement on the point that small and medium size enterprises (SME) are *the* outstanding engines of innovation (Harrison, 1997, pointed out the resource advantages of lager firms that gives them a dominating position in the innovation prozess), it should be doubtless that by engaging in this future-technologies they take part in re-innovating the economic system. Of course there is only a relatively small number of academic spin-offs founded on an annual basis[23], and their absolut contribution to national innovation systems is hardly easy to estimate. Nevertheless academic spin-offs take part in a knowledge- and technology-driven economical change and by this strengthen the competitiveness of national economic systems.

[23] Depending on different definitions of those companies between 800 and 2.600 (Egeln et al., 2003: 157)

This is the starting point of future economic development an therefore the basis to maintain prosperity in industrialized countries (ADT, 1998: 1).

To maintain competiveness in their markets, these academic spin-offs are forced to re-innovate their products and by this their knowledge basis in a steady process. As other studies pointed out before, academic spin-offs, especially within the first years after start-up, are struggling with a somewhat restricted financial basis. Uncertainties whether the business strategies of those firms which are founded on innovative and therefore so far unknown products or methods is in fact a sound based basis for economic success, their financial standing is rather below the average (Egeln et al., 2003: 141). Because of this internal investigations and development of new innovative products or an entry into new market branches on their own may well lead to a expenditure that cannot be raised by the spin-off itself. Schamp (2000: 50) stresses the risk to produce "sunk costs" that may lead to disfavorable allocation of resources. Besides of this risk-avoiding strategy, it is pointed out that "*learning and creation are* [...] *social prozesses*" (Bathelt and Glückler, 2000: 168). Learning by interacting is one strategy in the innovation prozess and the more specific the knowledge basis is the less should one (small) academic spin-off be able to face all challenges concerning research and development by itself. So to maintain competiveness and avoid risks young academic spin-off enterprises should use interactions with other actors. As a result of this, inter-firm co-operations come into focus of the spin-off´s business strategy. This paper discusses quantitative and qualitative aspects of such inter-organizational relationships by analyzing the co-operations of spin-offs that have been founded from the University of Bonn.

2. RESEARCH DESIGN

Though recently we have seen greater interest in scientific research about academic spin-off firms, in my opinion there are still uncertainties concerning the way these enterprises interact

with other organizations. An outstanding partner for academic spin-offs should be their incubator (Czarnitzki et. al., 2000). The personal contact to former colleagues should be deep and their business-field is directly connected to research formerly done during the employment at their University instituts. This leads to the assumption that interactions with scientific institutions are the most relevant form of co-operation for these enterprises. In deed recently we saw many investigations focussing on this interaction prozess. It is characteristic of this studies that they are to be undertaken in a certain research method: Subject of investigation usually is the density of co-operation between a incubator University and its spin-offs (Knecht, 1997, 1998; Czarnitzki et al., 2000; Spielkamp et al., 2002) as shown in the left part of figure 1 [insert figure 1]. Surveys of that kind deliver science-centric results with solid details about quantitative and qualitative aspects of interactions between a scientific organization and it´s spin-offs. But the point is that because of leaving out other actors that could well be of importance for the academic spin-off as a co-operation partner (e.g. other enterprises), in my opinion the possibility to estimate the scientific organization´s relative importance for the spin-off in that special context is missing.

To achieve information allowing to estimate each co-operation partners´ relative importance for academic spin-offs in their business prozesses, the research method to be used in this case is designed somewhat more general. By using a definition that *ex ante* does not exclude any conceivable partner, all co-operations of the spin-offs have been included into the survey – no matter which kind of organization it was.

Another aspect of this diploma thesis is the analysis of the importance of spacial proximity in the co-operation of academic spin-offs. It is assumed that academic spin-offs founded by scientists in contrast to the overall number of start-ups tend to cluster in spacial proximity to their incubator (Fromhold-Eisebith, 1992: 141; Egeln et al., 2003: 127). *"Geographic proximity is said to enhance social proximity by encouraging face-to-face interaction and the circulation of new information."* (Staber, 2001: 331). The results of the survey for spin-offs

from the University of Bonn underline this supposition with the majority of firms having their headquarter in the region of Bonn (defined as an area of 30km around the center of Bonn). It should be interesting to analyse whether this geographical proximity between the spin-offs and their incubator is reflected in the co-operations.

Before the interviews were conducted, from December 03 to January 04 a survey has been made at the University of Bonn to identify all spin-offs that have been founded since the mid-nineties. A postal enquiry to all professors at the alma mater contaning the request to send in contact details of spin-offs that have been sett up from their institute revealed an overall number of 41 *real* spin-off firms. Here in contrast to other surveys (e.g. "Athene", ADT, 1998) spin-off enterprises have been defined as those firms set up by scientists that have been working at the University of Bonn and whose business fields are obviously linked to research results originating from the University of Bonn. By this enterprises set up by graduates or without knowledge-transfer have been excluded from this study. Due to low returns (only 5,8% of the professors answeared to the enquiry) it ist not possible to estimate whether this number in fact reflects the totalitiy of academic spin-offs. However, it is reasonable that this number fairly certainly stands for the number of all known spin-offs that have been founded out of the University of Bonn[24].

By using a half-standardized questionnaire in personal interviews with 24 spin-offs (58,5% of the overall number) data about 81 co-operation partners was generated. The definition for "co-operation" to be used in this case is a very general one, as already mentioned before. It contained three major key-points that identified the co-operation, while separating it from market prozesses. In this study a co-operation is separated from only market orientated social interaction by:

[24] There is high correspondence between the survey results and the lists of spin-offs to be known to the University´s transfer-office and the probability that only those professors were inclined to send in replies that actually had spin-off set up from their institute.

1. it´s character as a relationship between independent actors that describe themselves as partners;
2. somewhat continuous interactions
3. monetary reasons (profit motive) not being the major argument for interaction

An assumption is that the University of Bonn itself will be from a quantitative perspective the most important co-operation partner for it´s own spin-offs. This all the more considering recently designed economic policy programs that promote academic spin-off foundations by strengthening close co-operations between them and their scientific incubator organizations. With reference to North Rhine-Westphalia the PFAU program has to mentioned.[25] To gain comparable data concerning the relationship between a spin-off and it´s incubator, the interview partner was allways a founder formerly employed at the University of Bonn. So the interviewed entrepreneurs somehow all had the same background concerning the spin-off´s incubator. Due to this person normally being in a management postion, the period of time for each interviw was set to a maximum of one hour. Therefore only the three most important co-operation partners in detail have been subject to the survey. For subordinated partners basic data sets have been interrogated (e.g organizational type and location of the partner, activities of the co-operation).

3. CO-OPERATIONS OF SPIN-OFF FIRMS FROM THE UNIVERSITY OF BONN

The overall result of the survey is quite obvious: co-operation as a business strategy does matter for academic spin-offs. Only one of the interviewed firms had no such partner. Average number of co-operations is >3 for each spin-off, modi are d_1=2 and d_2=4 (N=5 for each). While the spin off´s age does not show any impact on the quantitative shaping of co-

[25] For a period of 3 years the spin-off founder is granted an employment status at it´s University comparative to the status of a doctorate but without the duty of doing scientific research or giving lectures. By this the new spin-off can profit by using the internal resources of it´s institute without the need for personal involvement into the normal teaching.

operations, it is interesting that those spin-offs founded by more than one person in average maintain more inter-organizational relationships (3,6 co-operations) than those who were founded by a single person (2,3 co-operations). A possible explanation is from my point of view the influence of personal networks. The cumulative network of a team of entrepreneuers should be greater than the one of a single person. So there are more nodes that relationships can be "meshed" with. Another aspect could be that maintenance of a co-operation is labour-intensive. Inter-organizational prozesses are relayed to certain intra-organizational activities (research, production, marketing…). The more inter-organizational relationships a spin-off has, the more inter-organizational tasks it has to deal with. Because of team-founded spin-offs (both directly after start-up and in the post-start-up phase) having more human resources at their disposal, they can manage to conduct more co-operations.

Purpose of this survey was to gain information about the importance of different types of organizations as co-operation partners for academic spin-offs. Figure 2 shows that in overall three blocks of organizations have been indentified as partners [insert figure 2]: scientific organizations, enterprises and public institutions and associations of all kinds (e.g. comercial chambers or lobbies). As a first result it can be pointed out that inter-firm co-operations represent a larger number than those co-operations with scientific organziations. As mentioned before the partners have been listed by the entrepreneurs due to their importance. For co-operations with large enterprises an interesting outcome is that the share of these organizations as one of the (three) most important partners is with 21% larger than the overall part as shown in figure 2. Though three blocks of organizations have been identified, obviously public institutions and associations with only 9% of the co-operations being of this combination of actors, are of minor value as partners to academic spin-offs. Considering the overall number of 81 co-operations included in this survey, to gain valid information in the following chapters only the two blocks of inter-firm co-operations and those with scientific

organizations are analysed and compared. This comparison will be made up from a protagonistic point of view.

As pointed out before the spin-offs themselves are concentrated within the region of Bonn (21 of the interviewed 24 firms). Figure 3 shows that with 42% a large part of the partners also has his headquarter within this region [insert figure 3]. So for a part of the co-operations there is high spatial proximity between the academic enterprises and their partners. Therefore additionally in the following chapters for the mentioned two main blocks of organizations the importance of spatial aspects within inter-organizational processes is also analysed.

3.1 Inter-firm co-operations

In total other firms account for the largest part of co-operations. The 39 inter-firm relationships divide by three parts into vertical (with suppliers and customers), horizontal (with firms in the industry) and diagonal co-operations (with firms of other industries).

First contact to these partners in 50% of the cases was realized by the partners themselves. Both the University of Bonn and regional public institutions do not play an outstanding role in initiating these relationships (overall 4 cases for inter-firm co-operations). Though there are networking-initiatives to promote inter-organizational working, from my point of view they are not able to bring up real value to the spin-offs because of not being able to judge the internal processes and business strategies of each spin-off. By this they are not able to bring those persons to the table that actually do have potential interest in a however designed co-operation. This thesis is underlined by the fact that the only actors playing a significant role in building up contacts to new partners are those who already stand in a co-operative relationship to the spin-off. They are the only ones possessing of sound based information concerning the spin-offs´ internal business processes and needs (ca. 18% of the spin-off´s inter-firm co-operations came together through partners acting as bridge-builders).

The spin-off´s reasons for the choice of their partners reflect this, too. Complementary business and product strategies are the most important reasons to work together with another firm (22%, N=54). It is interesting that reasons vary between co-operations to SMEs and large enterprises. While for the first personal contacts and sympathy are important (26%, N=30), for co-operations to large enterprises exspecially the renommee and market strength of the partner are of interest for the spin-offs (20,8%, N=24).

In general, inter-firm co-operations typically are fixed on an informal basis, though with deferences between SMEs and large enterprises. The later are decisively more formal intitutionalized (8 out of 12 cases), which reflects minor importance of personal contact and sympathie for the formation of this interactions. In this cases uncertainties that result from possibly confused internal hierarchies of the larger partner are being reduced by an *ex ante* fixing of the co-operation´s details. This assumption is underlined by the fact that the entrepreneurs answeared to the question which were their major hindrances in working together with large enterprises, they see disadvantages in long-term decision-making prozesses and ignorance about who are relevant contact persons. Another argument for the formalized status of co-operations with large enterprises may lay in spatial distances. While 8 of the 26 SME-partners are located in the Bonn Region, none of the 13 large enteprises that the spin-offs identify as partners has his headquarter within this area. So formalization could be an instrument to minimize risks resulting from partners being somehow “out of sight”. Though from my point of view this is questionable. For both groups of partners the entrepreneurs characterized the interaction-rate as between weekly and monthly while mutual trust is high. So spatial proximity here does not directly implicate a higher social proximity.

Concidering the purpose of this article to identify similarities and differences between co-operations that academic spin-offs maintain with different kinds of organizations, the main question concerning inter-firm relationships is: What are major activities of these co-

operations? Due to restricted number of cases, activities have been clustered into 6 (7) categories:

1. **Research** (basic research, research under licence, research projects in co-operation with a partner for a common client)
2. **Development** (of products, of new technologies or methods, quality measures)
3. **Market activities** (common presentation, joined sales activities)
4. **Production** (joined projects, common product strategies, bundling of ressources)
5. **Know-how-Transfer** (consulting, exchange of knowledge, training)
6. **Unilateral use of ressources** (special case: use of the partner´s ressources without equivalent returns)
7. *No details*

Table 1 shows the activities of inter-firm co-operations separated by SMEs and large enterprises [insert table 1]. In general the spin-offs are at most engaged in fields of R&D activities with other firms. Obviously large enterprises are number one partners for joined (product) development. From my point of view this reflects the economical power of large enterprises. The use of their ressources often is the *conditio sine qua non* for the small spin-off firms to realize developments which they have on their agenda but are not able to solve them by themselves. So the reziprocal situation in this cases is characterized by the spin-offs being able to develop new products which they otherwise could not, while the large enterprise on the other hand benefits from the pin-offs specialized knowledge and maybe in a further step offer this product on their markets (with paying licence fees to the spin-off). Concerning activities with SMEs the majority is laying in the combined fields of joined production and common market activities. So while large enterprises are involved as partners in the early part of the production chain (R&D), partners that are somehow of the same size (concerning

employees) as the spin-off are used for productive and distributive activities, so at a later step of of the chain.

The joined work in production and marketing between the spin-offs and SMEs could well lead to unstable relationships due to the possibility of being a directe competitor for the co-operation partner in his market. At least for the academic spin-offs from the University of Bonn this assumption is not true. The entrepreneurs pointed out, that the partners do not compete but supplement to each other in respect to their market fields. I think this is a facette of flexible spezialisation. The spin-offs use their partners to solve activities they could not manage alone. In this particular cases it is exspecially the joined work on projects for a third party. One of the partners alone would not have been able to be engaged with the project. Only together the spin-off and the other firm can combine their specific strengthes and by this manage to receive and fulfill the tasks of their common customer. Competition is excluded directly from the beginning by separating the whole task directly from the start into sub-tasks to be fulfilled separately by one of the partners itself.

With only 5,6% the transfer of knowledge between the partners is an activity of minor importance. Though overlapping with research and development, which are *qua definitionem* knowledge intensive, this reflects from my point of view two things. On the one hand it is said that knowledge transfer, and more specific the transfer of not project bounded and rather tacit knowledge, takes place exspecially in face-to-face contacts (Butzin, 2000: 155). It has already been said, that the interaction is just on a weekly to monthly rate and consistently the type of interaction is dominated by E-Mail or telefon contact, not by face-to-face. So due to minor importance of face-to-face contacts knowledge-transfer therefore may also lack of importance. There is another reason: knowledge transfer may well be dangerous for the spin-offs. It is pointed out that exspecially for small enterprises the uncontrolled drain of knowledge is dangerous (Koschatzky, 2001: 142). Their economical basis is founded on academic research results which are unique and only applicable to them. To grant this

knowledge to a co-operation partner may well give him a competitive advantage leading to economic disadvantages for the spin-off when the partner uses this information for his own interests. Therefore from my point of view it is a kind of risk-minimizing business method of the spin-offs to bring in their knowledge into *ex ante* defined projects and not to give away precious knowledge going beyond this project-context.

3.2 Co-operations with scientific organizations

After having described inter-firm co-operations, in the following this will be compared to those with scientific organizations. From a quantitative point of view the later kind of co-operations with an overall of 35 partners is subordinated to the first, though difference is not that meaningful. With 30 cases, most of the scientific partners are Universities. Others are a *Fachhochschule* and some state-run research institutes. Outstanding partner with 21 co-opertions is the University of Bonn. With 19 of 24 interviewed spin-offs almost every enterprise to be established from this incubator maintains in a co-operative relationship to him.[26]

As already mentioned, academic spin-off foundation is subject to public support programmes. At least for the firms established from the University of Bonn there is no measurable influence of such incubator-based aid on the co-operation intensity between them. So the firms that have not been supported by the incubator do just as well co-operate with him as do supported firms.

In comparison to inter-firm co-operations the subordinated part of partnerships to be established on the spin-offs own initiative is striking. Only in one case the spin-off itself built up contact to a scientific organization which later on became a co-operation partner. For all other cases contact either already existed before start-up (mainly for co-operations with the

[26] Note: The difference between the 19 spin-offs maintaining a co-operation to the University of Bonn and the overall number of 21 co-operations to this organization is explained by the fact that some spin-offs have a co-operational relationship to more than one faculty, e.g. biology and medicine – in this cases they have been included as two independent co-operations to the survey.

incubator) or the partner directly adressed the spin-off and asked for a inter-organizational exchange.

In contrast to the overall number of inter-firm co-operations, those with scientific organizations are more formal institutionalized (65%), so founding on contracts or agreements. Though this formal protection may lead to the assumption that mutual trust between this constellation of partners is lower, it is indeed as high as seen for inter-firm relationships before (mainly within the category "very close"). The only difference is that trust into the University of Bonn as a partner tends to be higher than to other scientific organizations. Long term social relationships and personal contact throughout the years of former employment are reflected in this.

The same can be mentioned for contact-intensity between the partners. While the overall rate for all scientific organizations is comparible to inter-firm co-operations (weekly to monthly), contact rate to the University of Bonn is between daily and weekly. Spatial proximity in this cases simplifies personal interaction.[27]

Once again the main question is: What are the co-operations about, in other words what are main activities and how do they distinct from inter-firm co-operations – if at all?

Analogous to chapter 3.1 table 2 shows the activities of exchange prozesses with scientific organizations [insert table 2]. As was to be expected, with 59,3% in total the largest part of activities is laying in the fields of R&D. This correlates with a comparative figure of a nation-wide survey analyzing contacts between enterprises and scientific organizations where 60,9% of the activities are considered as R&D (Kulicke and Görisch, 2002: 61). Due to their status as a public corporation, activties aiming at marketing or joined production are no major focuses of co-operations with academic spin-offs. Concerning joined production only the incubator organization is of importance for the spin-offs. Here the support programmes

[27] Spatial proximity in this cases may also meens that the two partners are situated within the same building. Programs like PFAU and exspecially the Bonn-specific "in-house"-model promote this proximity and by this foster the contact-intensity.

enabling these enterprises to use exspecially technical equipment of the University for their own purposes comes to the light. The institute itself benefits as a ruel by the allowance to use the good to be produced by the spin-off on it´s equipment.

An outstanding result is knowledge-transfer only being of relevance for co-operations between the spin-offs and their incubator. As already pointed out before, this transfer differs from the knowledge transfer bundled to R&D activities by not being connected to any specific project or somehow defined field of interaction between the partners. It has been mentioned that this exchange of knowledge may well contain the danger of know-how drain for the spin-offs. Therefore from my point of view it is an outstanding fact that only the relations to the University of Bonn are suitable for this kind of activities. Though mutual trust is as high as to other scientific organziations, only the long-term relationships to former colleagues at the institutes of the incubator are likely to induce this transfer. While both the rate of mutual trust an the rate of face-to-face contacts do not show significant impact on the question whether transfer of tacit-knowledge takes place or not, there is a significant correlation between this activity and the age of a co-operation. Therefore it can be pointed out that the longer a co-operation between the spin-off and a scientific organization lasts, the more likely is the exchange of tacit-knowledge between the two actors. Nevertheless it has to be mentioned that this no sound based thesis due to low overall number of cases.

So summarizing co-operations to scientific organizations are mainly focussed on R&D activities. Trust and contact intensitiy is comparable to inter-firm co-operations.

A difference between the two co-operations blocks is the persistence of hindrances. For every co-operation partner to be included with detailed data in this survey, main points of hindrances or frictions have been interrogated. While the quantitative difference of how many hindrances there are refering to inter-firm co-operations or those with scientific organizations is not outstanding, the persistence indeed is. Those being characteristic for relationships to scientific organizations tend to maintain over time. On the other side the majority of frictions

the spin-offs had to face while working together with other enterprises ceased after a period of time.

4. CONCLUSION

The first an most obvious result is that two types of organizations play a role as co-operation partners for the spin-offs from the University of Bonn. A third block formed by public agencies and associations is not important, both from a quantitative and qualitative point of view.

Besides of the results for co-operations with the University of Bonn, it is ovious that personal contact in face-to-face situations does not play outstanding roles in the co-operation prozess for academic spin-off enterprises. After activities and circumstances of the relationship have been fixed, exchange on a more or less weekly basis and mainly by E-Mail or phone is sufficient to maintain the co-operation on a stable basis. The minor importance of spatial proximity is deduced from this. Leaving out the co-operations with the University of Bonn, only 23% of the partners are situated within the Region of Bonn. This is even more underlined by the fact that exactly the same part of co-operations is with organizations outside of Germany, and still both the rate of mutual trust and fce-to-face contacts to not vary. Elsewhere it has been pointed out transfer-agencies and the like do not have the assumed influence as contact-establishers for companies (Fritsch and Schwirten, 1998: 255). Here too, there is no measurable influence of any intermediary organization playing a role as contact-establisher for the academic spin-offs. Therefore from my point of view it is doubtful whether Universities should engage in such networking-activities aiming at the promotion of co-operational relationships. Due to not being able to judge all internal business-prozesses of the spin-off they should not be able to establish contact to the best-fitting partner organization. So by engaging in this activities, transfer agencies may well waste ressouces on a subject which they cannot fulfill as good as the spin-off itself. On the other hand I has to be poited out

transfer-agencies are welcome as advisers in a later step of the formation of a co-operation, namely the legal arrangement behind a inter-organizational relationship. By giving examples and maybe best-practice solutions they can deliver real service to science-based spin-off enterprises in a field were they possibly lack knowledge and experience.

Concerning hindrances, the persistence of this factors is the main difference between the two co-operation blocks. From my point of view this difference is the result of organizational differences. While in inter-firm co-operations tend to be somehow more “the same” (both enterprises with profit maximization being to overall main goal), co-operations between the spin-off and a scientific organization have to face the problem that they aim at different goals (enterprise / public institution).

The final question left to answear is: Why do the spin-offs of the University of Bonn co-operate? Generally spoken the answear to this is: The academic spi-offs co-operate because they are small. Shortage of ressources, both material and immaterial (e.g. information concerning markets, marketing strategies or production methods), are *the* outstanding main resons for the majority of spin-offs to maintain interorganizational relationships. Both with other enterprises and scientific organizations, the spin-offs tend to gain access to ressources they use to conduct tasks they otherwise cannot or atl east concern them as too risky to invest into.

So co-operating is a business strategy for the (rather small) acadmic spin-off enterprises from the University of Bonn to achive flexibility, avoid risks and achieve goals being out of reach if they only acted on their own.

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Figures and Tables

Figure 1: Research method to be used for the analysis of the co-operations of academic spin-offs

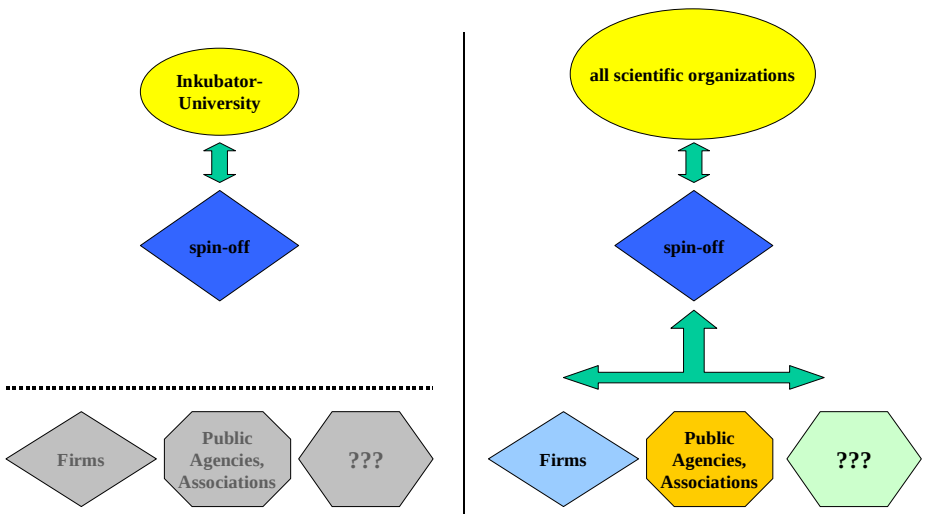

Figure 2: Number of co-operation partners by organization (absolut and relative)

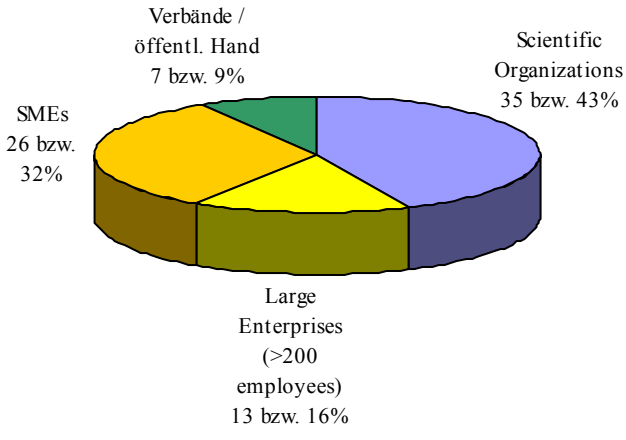

Figure 3: locations of the co-operation partners

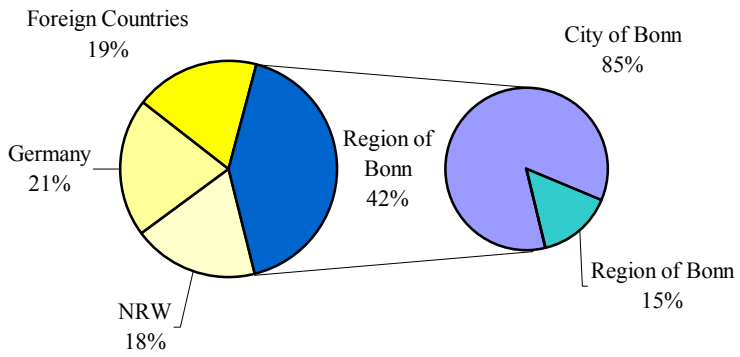

Table 1: Activities of inter-firm co-operations

Activities	SMEs absolut	SMEs relativ	large enterprises absolut	large enterprises relativ	Total absolut	Total relative
Research	7	**14,0**	3	**14,3**	10	**14,1**
Development	13	**26,0**	13	**61,9**	26	**36,7**
Market activities	13	**26,0**	4	**19,0**	17	**23,9**
Production	14	**28,0**	0	**0,0**	14	**19,7**
Know-how Transfer	3	**6,0**	1	**4,8**	4	**5,6**
unilateral use of ressources	0	**0,0**	0	**0,0**	0	**0,0**
no details	0	**0,0**	0	**0,0**	0	**0,0**
gesamt	**50**	**100**	**21**	**100,0**	**71**	**100,0**

Source: own research

Table 2: Activities of co-operations with scientific organizations

Activities	University of Bonn absolut	University of Bonn relativ	other scientific organizations absolut	other scientific organizations relativ	Total absolut	Total relativ
Reserch	11	**28,2**	8	**40,0**	19	**32,2**
Development	8	**20,5**	8	**40,0**	16	**27,1**
Market activities	1	**2,6**	2	**10,0**	3	**5,1**
Prouction	5	**12,8**	0	**0,0**	5	**8,5**
Know-how Transfer	10	**25,6**	0	**0,0**	10	**16,9**
unilateral use of ressource	4	**10,3**	1	**5,0**	5	**8,5**
no details	0	**0,0**	1	**5,0**	1	**1,7**
gesamt	**39**	**100**	**20**	**100,0**	**59**	**100,0**

Source: own research

ProWomEn - A network to foster innovative entrepreneurship among women

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INTRODUCTION

The number of women who are self-employed across the European Union is very much smaller than that of men and the number of women entrepreneurs with employees is even smaller. In 2000 only 8% of the total number of women in work were self-employed. This was only half the proportion of men in work who were self-employed. However, there is increasing evidence that more and more women are becoming interested in starting a business (Franco and Winqvist, 2002). Also in innovative sectors women face the same barriers as women entrepreneurs in other areas. The advantages of education and experience do not totally compensate for disadvantages they have to face because of their gender. Women lack the support and role model effect of other women and need to develop business credibility on their own. The single entrepreneur style favoured by women is the antithesis of the teams required by university and commercial science. There are fewer women in innovative sectors, but this is less related to personal characteristics and abilities and more related to structural and experiential factors (Carter, 2003).

Since 2001 a European network co-ordinated by a consortium from Baden-Württemberg deals with women entrepreneurship in order to identify good practice in the promotion of

female start-ups, to establish innovative support schemes and to receive ideas for new support models. The network was supported by the European Commission, DG Enterprise in the framework of it's Innovation Programme.

The ProWomEn network involves 16 European regions and is co-ordinated by the Ministry of Economic Affairs Baden-Württemberg and Steinbeis-Europa-Zentrum. The member regions include such that have already implemented structures to promote women entrepreneurship as well as regions that do not have much experience, but recognised a need. Besides the German States Baden-Württemberg, North Rhine Westphalia and Thuringia, regions from the Czech Republic, Belgium, England, France, Hungary, Italy, Ireland, Poland, Spain and Sweden have contributed to ProWomEn. Among the members are organisations for economic development, technology transfer as well as four universities (Linköping University, Polytechnical University of Barcelona, Czech Technical University Prague, Dundalk Institute of Technology).

FIELDS OF WORKS

Four key issues in the promotion of women entrepreneurship were chosen from many important aspects:

- **Problem awareness**: Which differences in entrepreneurship exist between women an man?, How to sensitise support organisations for women specific approaches? How to encourage women to consider being self-employed in their private and professional decisions?
- **Instruments of Support**: Which support do women entrepreneurs need? How to respect gender related differences in entrepreneurship support? How to gender mainstream support schemes?

- **Regional networks**: Which benefits can be taken from networking? How can female start-ups and women entrepreneurs network? How to network among intermediary organisations?
- **Education and training**: How to respect gender related aspects in entrepreneurship qualification? How to reduce gender related problems through education?

THE ProWomEn LEARNING PROCESS

With a method specially designed for ProWomEn the network members identified critical success factors and selected good practice examples.

Figure 1: ProWomEn learning process

The starting point of the project was a detailed survey on women entrepreneurship in the participating regions by means of questionnaires. Women specific activities as well as general support programmes with focus on gender aspects were gathered in an extensive data collection.

The next step identified critical success factors for all four key issues. Critical success factors in this context are seen as "a small number of topics that are influential in determining the positive outcome of an activity" or "those few key areas of activity in which favourable results are absolutely necessary to reach one's goals". The critical success factors should on the one hand meet the requirements of tried an tested scientific methods and on the other hand be flexible enough to respect individual regional or personal aspect. Therefore a two-step approach to identify critical success factors was chosen. Assisted by creativity methods the members looked for factors which appeared important to them, both personally and with

regard to their regional framework conditions. The success factors identified were then evaluated according to their relation to standard criteria like relevance, effectiveness, efficiency, utility or sustainability. By means of this two-step procedure regional peculiarities and supra-regional aspects could equally be considered. Between 9 and 14 critical success factors for each of the four thematic issues were identified.

Figure 2: Important critical success factors

To identify good practice the data collection was screened according to the critical success factors determined. All examples that meet at least half of the critical success factors were considered as good practice.

Figure 3: Selected examples of good practice

Determining whether one of the over 80 examples of good practice is outstanding also depends on individual framework conditions and objectives in the regions. Support organisations having to achieve certain objectives with a given budget will have another opinion on this question than decision makers who seek for activity that creates strong publicity. With regard to this fact the members jointly selected three examples for each of the thematic issues.

In a final step the representatives of the regions developed general implementation plans which enabled them to set-up activities they learned about during the ProWomEn project. The network members also set up ideas for further joint projects.

RESULTS FROM THE SUB-NETS

Problem Awareness

The types of barriers and problems women face when starting their own business seem not to differ too much in Europe however their strength varies from region to region. In general two types of problems can be identified. Obstacles that prevent women from starting an enterprise and problems which arise during the starting process. Lack of role models, difficulties in balancing family and work, or economic problems in traditional sectors are reasons why women do not start their own business. Those who take the chance often have to face new problems like missing networks, male dominated support systems or even real discrimination. Long-term solutions have to start in the educational system. For the mid-term, information and qualification of intermediary organisations' staff can be helpful. Role models who draw a realistic picture of female entrepreneurship can encourage women to take the chance of being self-employed. A campaign of information days carried out in Baden-Württemberg, awards in Ireland or Poland or a Swedish exhibition on women entrepreneurs could set examples on how the whole range of women entrepreneurship can be made visible.

Instruments of support

In the long run successful support programmes have to pursue the objective of equal opportunities for women and men and to promote a culture of women entrepreneurship. Women resource centres on local level, national competence centres or agencies for women entrepreneurship as well as purposeful public relations, projects in schools and resource centres for women entrepreneurs contribute to achieving this goals. But in the mid- and short

term, women still need individual help when translating their plans into action, financing their projects or accessing networks. Examples like the Swedish "Starting Line" or micro-financing programmes existing in England and Spain can act as good practice just as the "Women Entrepreneurs Meetings" existing in various regions of Baden-Württemberg.

Regional Networks

While men have always used their "old boy's network" to initiate business, to generate business contacts and to collect information, women often have scruples about using networks for the benefit of their enterprises. They often think being a network member means permanent active collaboration and underestimate the strategic aspect of networking. Support organisations although have a need for regional and trans-regional networking in order to build up competence and to back up and strengthen their activities. Successful networks need clearly defined objectives, target groups and organisational structures. Visions, strategies and openness for changes are crucial elements of thriving networks. Good examples in this context are the English networks "WIN" and "Prowess" as well as virtual "Women Entrepreneurs' Portals" in Baden-Württemberg and North Rhine Westphalia.

Education and training

It is generally agreed that entrepreneurial education should be a long-term objective and has to start as early as possible in the education process. School firms and business games support entrepreneurial thinking and acting, promote personality development and help to reduce gender related problems in an early stage. When preparing for the actual start-up women require specific training. Training activities should be based on an interdisciplinary approach that builds up on both hard facts and soft skill and also involves successful women entrepreneurs. In this context imparting theoretical knowledge and sharing hands-on experience is equally important. The "PriManager" competition in Baden-Württemberg and

the Belgian "DREAM" project are good examples for school activities. Modular training schemes in Belgium, Spain and Baden-Württemberg as well as the "TWIN" mentoring project in North Rhine Westphalia give ideas for the design of qualification activities.

RESULTS AND OUTLOOK

The ProWomEn project identified a great variety of gender specific support activity or general support schemes that follow a strong gender mainstreaming approach. Although there are regions in Europe where only little gender specific promotion is available, especially in the new member states. In regions where entrepreneurship support has to be built up from scratch there is often no or only very little focus on specific target groups in the beginning. However it might be easier to include gender aspects in new support schemes right from the beginning than to add them later on.

In all member regions ProWomEn had positive impact on the promotion of women entrepreneurship. For example a mentoring project had been transferred from North Rhine Westphalia to Yorkshire or the region of Pilsen organised for the first time a discussion forum on women entrepreneurship. Baden-Württemberg could benefit from the co-operation with NUTEK the Swedish Business Development Agency. 22 of the good practice examples identified in the framework of ProWomEn were described in detail in a "Book of Good Practice in the Promotion of Women Entrepreneurship", available in English and German (www.prowomen-eu.net). Results of the Networks activities such as examples of good practice, case studies and pilot actions were presented at a conference in September 2003 in Stuttgart, Germany.

During the work of ProWomEn it also turned out that support for female start-ups and women entrepreneurs mainly focuses on traditional industry sectors often preferred by

women such as trade and services. While a lot of excellent support schemes for innovative and university based start-ups as well as good "women and science" programmes exist nearly all over Europe hardly any support for innovative women start-ups is offered. For example only two out of more than 200 projects of the EXIST network supported by the German Federal Ministry for Education and Research exclusively target women entrepreneurs ("deluex" in Lübeck and www.gruenderinnen.de in Karlsruhe). It is a fact that the women quota is much lower for university based start-ups than for all start-ups, e.g. in Baden-Württemberg only 12% of start-ups in university incubators are lead by women while around 33% of all business starters in the region are female. This expresses that there is a strong need for support schemes that target innovative women start-ups and entrepreneurs. Responding to these needs a new support scheme for university incubators launched by Baden-Württemberg's Ministry of Economic affairs puts a strong focuses on gender aspects. For every proposal an action plan how to increase the number of female start-ups is a key criteria for eligibility and an extra budget will be allocated to pilot actions that have either region wide relevance or can act as models for other university incubators.

The knowledge gained in the ProWomEn project and the lack of support for innovative women entrepreneurs were also the base for another European project. The WomEn2FP6 project aims at bringing women entrepreneurs into European research projects and trans-national co-operation. The project includes training for women entrepreneurs, brokerage and matching of women entrepreneur's profiles and exchange of experience among intermediaries.

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FIGURES

Figure 1: ProWomEn learning process

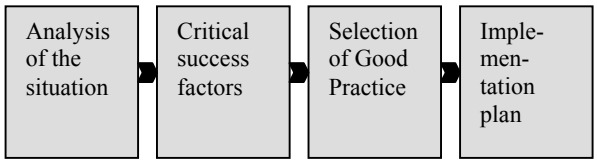

Figure 2: Important critical success factors

Problem Awareness	Instruments of support	**Regional networks**	**Education and training**
communi-cation / visibility shows realistic role models involves partners	flexibility supports different phases of the enterprise practical approach involves experts	publicity defined target group defined organisational structure	meets the needs for different phases of the enterprise involves women entrepre-neurs

Figure 3: Selected examples of good practice

Problem Awareness	Instruments of support	**Regional networks**	**Education and training**
Campaign of information days (BW) Information service for women entrepreneurs (BW) Exhibition on women entrepreneurs (S) Awards (PL, IRL, B)	Support of information and qualification (S, BW) Micro-Financing and alternative financing (UK, S, PL, E, BW) "Women Resource Centres" (S)	Network for intermediaries (BW, NRW) Virtual networks (BW, NRW, E) Networks for women entrepreneurs (UK)	Modular qualification schemes (BW, B, E) Mentoring (NRW) School projects (BW, B)

University involvements in University Business Incubators and their Impact on the Start-ups

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ABSTRACT

Universities are often sources of spin-off new ventures based upon leading edge research. Potential entrepreneurs are academics, research staff, doctoral candidates or students. This know-how, human capital, and network access – are critical resources to entrepreneurial companies in general. Therefore universities play a major role in generating and coaching young start-ups, not only for university spin-offs. Universities can facilitate the transfer of critical resources to the business through the process of research commercialization and technology transfer. Universities can also organize the critical resources of human capital and specific entrepreneurial experience into a separate entity or facility to assist young entrepreneurial start-ups for success, called university business incubators (UBI). Depending upon the form of cooperation between university, UBI and start-ups, these units can offer an additional interesting way to generate income for the university. In this paper we present the results of a survey of over 300 university business incubators worldwide. Of the over 130 respondents, 44% are located in the USA or Canada, 41% in Europe and 15% in the rest of the world. The managers of the university business incubators were asked to complete a six-page questionnaire.

INTRODUCTION

An incubator assists start-ups in setting up their business and starting operations. The specific tasks of a start-up firm differ greatly depending upon their industry. Biotech companies tend to emphasize R&D investments while a firm with a new "high tech" product wants to achieve proof of concept or build a prototype. Incubators assist such firms in the pre-seed and seed phase (Klandt, 1999). There is no formal or legal definition of an incubator. However, Smilor & Gill's definition is useful:

> **"…an incubator is an apparatus for the maintenance of controlled conditions for cultivation. To incubate fledgling companies implies an ability or desire to maintain some kind of prescribed and controlled conditions favorable to the development of new firms. The incubator seeks to give form and substance – that is, structure and credibility – to start-up or emerging ventures".** (Smilor and Gill, 1986: 1)

Universities are sources of leading edge research and of potential entrepreneurs, formerly academics, research staff, doctoral candidates or students. This know-how, human capital, and network access – are critical resources to entrepreneurial companies in general (Dowling and Drumm, 2002).

Figure 1: Availability of resources at universities

Therefore universities play a major role in generating and coaching young start-ups, not only for university spin-offs. Universities can facilitate the transfer of critical resources to the business through the process of research commercialization and university business incubators (UBIs) can be distinguished from other public or private incubators, private business parks, corporate incubators and "virtual" incubator organizations without a physical structure. The priority of public or private science parks is to rent space to young companies.

They seldom offer further advice or support to the companies. In comparison, private business incubators lack the relationship to an university with its complementary assets and services. Corporate incubators are only oriented towards the technological or business focus of the related company.

The first incubators supporting start-up companies were set up in the USA. The oldest incubator in the world is "Student Agencies Inc" from Ithaca, New York, which began supporting student entrepreneurial initiatives as early as 1942. The first business incubator was the "Batavia Industrial Center", founded in 1959 in Batavia, N.Y., USA. By 1980 there were already 12 incubators in the USA, and by 1984 the number had risen to 63 (Allen, 1985). In 2000 the number of incubators in the USA was estimated by different sources to be between 800 and 1000 (McKinnon and Hayhow, 1998).

There have been a variety of studies conducted in the US on the influence of incubator organizations on company development. These studies show that the success rate is higher for start-ups in incubators: 87% of all companies started in an incubator survive the first five years successfully (Molnar et al., 1997). Without an incubator, over half of the start-ups disappear during the first five years (Smilor and Gill, 1986). As early as 1992 over 50 US universities or colleges had their own university incubators (Mian, 1994). According to a survey by the NBIA (National Business Incubation Association, 2002), in 1998 approx. 19% of all US incubators were run by universities or colleges.

University-based incubators typically pursue two goals: job creation and its related socioeconomic effects (strengthening economic development and diversification, increases in tax revenue), and profit, i.e. incubators can be operated purely for financial reasons. Some incubators also have other goals, such as technology transfer and research commercialization from universities, entrepreneurship education and providing opportunities for external research.

PREVIOUS RESEARCH

There is a lack of academic research on business incubation focusing on university based incubators. There have as yet been no exclusive UBI surveys conducted globally involving a large, comprehensive sample size (Steffensen et al,. 1999). The focus has been primarily on technology transfer from universities (Shane, 2002) typically using cases from the US (Bray and Lee, 2000). For example, Matkin (1990) focused on the technology transfer mechanism at four top US research universities. McMullan, Long and Graham investigated the value added by university-based outreach programs from 89 projects of the new venture office at the University of Calgary (McMullan, Long and Graham 1986). Mian (1994, 1996a, 1996b, 1997) investigated 6 US university business incubators in detailed case studies including such issues as management and strategy, value added, performance, and organizational aspects. Allen and McCluskey (1990) interviewed business incubators from the National Business Incubation Association in the US via questionnaire. 15% of the 127 incubators were university-related. Culp and Shapira (1997) investigated Georgia´s Advanced Technology Development Center (ATDC) as a single case study of an university business incubator. Lilischkis (2001) employed a case study approach to compare the University of Washington in Seattle, USA to the Ruhr Universität Bochum, Germany, concerning their assistance in creating and supporting start-ups from university. Cooper (1985) investigated 161 start-ups in the US regarding the influence of their incubator organization, 27 of which came from an university.

The literature on university technology transfer has focused on research universities (Lockett et al,. 2003), on gaining income for universities by spin-off companies (Thursby et al,. 2001) and on research commercialization issues in general (Colyvas et al,. 2002; Zucker et al., 2002).

THEORETICAL BACKGROUND

The ‚Resource-Based-View of the firm' – approach by Wernerfelt (1984) and Penrose (1995) sees businesses as *a bundle of resources and skills* with the purpose of generating a fluent rent as result of entrepreneurial acting. Regarding the perception of „*Resources"* Penrose sees the business as a collection of productive resources, divided into ‚physical' and ‚human resources (Penrose, 1995: 24). Wernerfelt defines resources as everything that can be understood as a business's strong points and weaknesses or more formally: all material and intangible assets that are linked with the business semi permanently (Wernerfelt, 1984: 172). Basically resources can be divided into tangible, intangible and, as a hybrid, human resources. Real estate, liquidity and physical infrastructure represent examples for material resources. (Patented) technology, know-how, reputation, clientele and corporate culture establish the immaterial resources of a business. Education, experience, flexibility and the commitment of the individual staff member belong to the human resources (Portes, 1998)[28].

The four characteristics of resources (*valuable*, *rare*, *only incompletely imitable* and *not replaceable*) contribute to the generation of competitive advantages for businesses. Yet such a competitive advantage mustn't be of indeterminate duration. The individual single business stands in the focus of the Resource-Based-View. Resources and skills are looked upon as business specific, centering on the business' properties and collection of resources (Lechner, 2001: 34).

The basic assumptions (recoverability, rareness, incomplete imitability and missing replaceability) applied to the Resource-Based-View are also partly valid for the resources of young foundations. Especially foundation specific knowledge about organization and funding of young businesses is completely substitutable, for example through university business

[28] Instead of human resources it is advised to distinguish again into „social capital" because it is not only work force (Portes, 1998)

incubators. In addition this resource is totally mobile, but its market[29] is very limited. A young business foundation usually has single definite resources (Arbaugh and Camp, 2000: 313)[30], e.g. a technological unique selling point. However, especially new foundations are characterized by the paradigms **liability of newness** and **resource poverty**[31]. Regarding the university business incubator's resources and additionally applying the Resource-Based-View, which is about the achievement of sustainable competitive advantage[32], it is furthermore considered that this view is focused on competing businesses. Because of this, the Resource-based View can only be rudimentarily consulted for the explanation of Non-Profit-Organizations, which are not competing directly on the market. The competitive advantage of university business incubators is determined by their general aim[33], which in turn exclusively applies to incubatees. The securing of survival and additionally the encouragement of growth of the incubatees is the primary competitive advantage of an university business incubator. Thus it is not the matter of competitive advantages in a narrower sense, meaning the realization of an above-average rate of return and the acquisition of market shares, but a matter of competitive advantages in a wider, rudimentary sense, meaning the securing of survival and the enablement of growth in the business's early phases.

The securing of survival is also basically the intention of already existing businesses with a history (Barney, 1996: 34). But in doing so these businesses can normally fall back on one or the other of their own resources or on an already established instrument, for example on an existing product or service, capital stock, clientele or staff pool. In recently founded

[29] e.g. of the foundation assistants and the incubators.

[30] Arbaugh and Camp (2000: 313) speak of ‚available resources', ‚controlled resources' and 'required resources' in the entrepreneurial process.

[31] See in detail chapter III.1.

[32] As in the transaction costs approach.

[33] See chapter III.3.3 orientation of university business incubators.

businesses it is not the matter of this basic securing of the business's survival during the business's progress, but paramount is the securing of survival in a very early phase of the venture without the possibility to fall back on one's own resources. Also the aspired growth in this phase is essentially not about prevailing against competitors on the market and gaining a share of the market, but primarily about the acquisition of reference customers and the assembling/structuring of the founder- and the first staff teams.[34]

The Resource-Based-View's basic assumptions (recoverability, rareness, incomplete imitability and missing replaceability) are also partly valid for the foundation specific knowledge of university business incubators. Especially, according to the paradigms **liability of newness** and **resource poverty,** new foundations lack crucial know-how of experience in the business foundation process and for growth. This foundation specific treasure of experience can only be provided by the employees (and also in a wider sense by the network partners) of the university business incubator.

=> The foundation specific knowledge of the university business incubator's staff can be explained from the Resource-Based-View.

The UBI provides a formal mechanism for embedding start-up companies more quickly in entrepreneurial networks and thereby can assist such companies to develop their own set of relationships (Schmude, 2002: 256) more quickly. Such relationships increase the probability of survival (Hisrich and Smilor, 1988; Uzzi, 1996; Lechner and Dowling, 2003). An UBI represents a node in the developing network for a start-up company that includes partners for research, financing, consulting, and regulatory matters. The most important success factors to be considered for many technology-based firms in UBIs are recruitment of qualified employees and the acquisition of external financing. Universities often represent an important

[34] In a foundation's seed phase there are substantial asymmetries of information as well.

source of additional personnel for the start-up firms, in particular in the area of R&D, but also for other positions. Professors at universities often serve as research or business consultants. The university partners may consist of other universities or colleges, research institutions or other higher educational institutions. An UBI can also achieve a clustering effect that enables its incubator firm to more easily attract financing from venture capitalists, business angels or banks.

In addition to these direct effects of personnel recruitment and financing, many new firms develop cooperative relationships that can be crucial in the early start-up phase and development of the company. For example, firms often need to recruit for management or board positions or add experienced managers in areas not covered by the founding team. Incubators can also provide a link to important external institutions such as government agencies, trade associations, foundations or technology transfer offices. Such relationships improve the chances that start-up firms can get access to government subsidies. In addition, incubators can serve as a network node point for relationships with important external consultants, such as tax accountants, patent and other lawyers, business consultants, marketing and public relations firms. Such relationships can be crucial to the development of the firms**.**

METHODOLOGY

Selection of Incubators

Because there is no formal definition of an university business incubator, specific criteria were developed to identify such organizations. The criteria are based on the physical and legal position of an UBI at an university, the type of relationship to the university and the model of an UBI derived from the general business incubator literature. The individual criteria used in this study were:

- a legal or organizational relationship with an university

- located on or next to the premises/campus of an university
- a formal institutional structure (department, profit center)
- exchange or use of resources with the university
- business intention is business incubation
- provision of physical space or services
- provision of organizational services for start-ups

Furthermore, to be included in our survey the UBIs had to meet the following criteria:

- external promotion of their services (e.g. via a homepage in English, German or French)
- identification as an "University Business Incubator" or "University related Incubator" and provide the name of the related university

Sample and Study Design

Since there is no comprehensive list of university business incubators, for this study a database of 363 potential UBIs worldwide was created in 2002. 53 organizations did not meet the criteria listed above so that the net UBI database contained 310 UBIs, 46% of which are located in America (90% of these in the US), 42% in Europe (49% of them in Great Britain), 10% in Asia, and 2% in Australia. We believe that this database includes almost all existing UBIs worldwide. To ensure that the answers had a high validity, the questionnaires were sent only to UBI managers. The final sample consists of 130 UBIs (44% response rate).

Potential Bias

The data from the UBIs was self-reported and only one person per incubator was asked to fill out the questionnaire. Incubator managers were also asked to report on employee growth rates and sales for their incubatees. A review of the contact data supplied by the person who had

filled out the questionnaire confirmed these people were incubator managers. Considering that the respondents could have been biased to over-emphasize success when they answered the questions about growth measures, a bias analysis was conducted. However, non-respondents showed no difference between the countries nor any other significant effects.

RESULTS

The following data show descriptive characteristics of the UBIs studied. Not all respondents provided data for every question. In such cases the number of responses is given in parentheses.

Age of the UBIs

Regarding the age of university business incubators the data show that there are two focal points in the years of establishment: 1986 and 2000, as shown in figure 2. The second focal point is quite obviously due to the new economy hype.

Figure 2: Year of establishment of the UBI

Profit Orientation

An important criterion for distinguishing between UBIs is their profit orientation. Of the 130 responding UBIs 110 (85%) are Non-Profit Organizations (NPOs) and the remaining 20 (15%) have a for-profit orientation. This description varied greatly by region ranging from a 28% for-profit orientation in Europe to 5% in America, as shown in Table 1. This might reflect the fact that most incubators in Europe were established later than in the US. This explanation was suggested by the incubator managers who filled out the questionnaire. Categorizing an UBI as having an NPO does not mean that they do not take equity for services, however.

Table 1: Profit orientation by Region

Organizational Structure and Importance of the Related University

To maintain a legal or organizational relationship with an university was a formal criterion for being included in this study as an UBI. 54.2% of the respondents have a separate legal entity, and 37.9% of these are private companies. The related university has equity positions in 8% of the UBIs. The average investment is 40.5%. Over half (51%) of the UBIs are located on the campus of the related university and 22% of the respondents stated that they were located near the university campus. Only 27% are located far away from campus at an average distance of 8.6 km.

We found that 36 of the related universities have a research focus, 35 universities have a teaching focus and 30 universities have a teaching and research focus (n=101). Regarding the formal criteria for an UBI to use or exchange resources with the related university, it was found that 79.8% of the UBIs use university facilities (n=104). In most cases laboratory space and facilities and also IT network, library, conference rooms and catering were used.

There is evidence from earlier research that the reputation of an university has an effect on the spinoff rate (Sine et al. 2003). The UBIs in this study (Lendner, 2003) rated the importance of their related university's reputation to them at 6.0 on a 7-scale Likert index (n = 103). The importance of teaching and training in Entrepreneurship was rated on the same scale at 5.2 (n= 103). The entrance and exit criteria of an UBI can also serve as a rating criterion for the incubatee (Lendner and Lichtinger, 2004). The university can serve as a committee member in the advisory board or investment committee of the UBI.

Services provided by UBI

To provide physical and/or non-material services for start-ups is one of the important characteristics for an UBI. The type of services that are critical for start-ups in the seed phase or early stages were collected. 74% of the for-profit UBIs stated "Providing seed financing" as one of their professional services, whereas only 34% of the non-profit UBIs also offered this service. This difference showed no statistical significance. No other professional services showed significant differences between non-profit and for-profit UBIs. The frequency of provision of the professional services is shown in Table 2.

Table 2: Professional services offered by an UBI

Regarding the organizational services, there was no significant difference for any of the services provided between non-profit and for-profit UBIs.

Table 3: Organizational services offered by an UBI

Sources of Financing of the Incubator

A major characteristic of incubators in general is how they generate their own cash flow (Rice, 1995). There are important short-term income streams and interesting long-term options available. In the long run the equity investment of the incubators in their firms is a potential source of funds if the incubated firms are successful. Our data show that an UBI's main income is the rent or fees paid by their incubatees. 91% of the UBIs said they charge their incubatees rent (n=120). 38% of these charge rent at market rate, 57% below market rate and the remaining 5% above market rate. About half of the UBIs (53%, n=101) bill their

companies for service charges, and 19% of them (n=101) charge consulting fees. 26 % of the UBIs said they take equity for services (n=130). The level of equity ranged from 1 - 20%, with the mean at 6.7%. 12% (n=101) of the Incubators have sold equity as a source of their own cash flow. 22% have a seed fund available to invest in their incubatees (n=105).

University involvements in the university business incubator

Apart from providing network contacts the related university can provide critical resources.

- The university can serve as a committee member on the board of directors, in the advisory board or investment committee of the university business incubator.
- In addition to that the university can contribute to the finance of the university business incubator by providing equity, grants, subsidies, loans and donations. The related university can also contribute to create own cash flow for the university business incubator.

Especially because of the reason that financing by "intelligent capital" is expected to be a crucial resource of young companies, the involvement of the related university in the finance of the university business incubator may contribute to the success of their companies which can be expressed in the employee-growth-rate. The results shown in table 4 underline this expectation. UBIs who receive grants or subsidies from the related university do have a higher employee-growth-rate of their incubatees (108,93) than UBIs who do not receive grants (88,58).

Table 4: University involvement in funding of UBIs

The same effect is shown if the university is an equity investor in the UBI though effects may result in the fact that the university provides some sort of "brain capital", apart from

providing network contacts (97,88). If the university is serving as a committee member in the advisory board of the UBI, their incubatees show a higher growth-rate in employees (85,88).

Table 5: University involvement as committee member

IMPLICATIONS AND CONCLUSIONS

This international study on University Business Incubators (UBIs) has brought new insights on the factors that influence success of UBIs and their incubated firms. Our results provide initial support for a "Resourced Based View" - explanation of the benefits for start-ups of beginning their firm life cycles with the help of an incubator. These results may also be of practical relevance for institutions planning to establish, or that are already running an UBI. Network ties to financial institutions and other industry and government partners may be the key to the success of the firms in the incubator and therefore to the UBI itself. Young firms that have a choice should look for an incubator with the strongest set of such relationships.

Young firms thinking about joining an UBI should also consider the number and kind of professional and organizational services which an UBI offers. Both directly and via its network, the UBI also provides its firms with critical resources, such as seed financing and human capital. The growth of firms in an UBI will also be positively influenced by the level of services in the UBI and its network. There is a valuable impact from the related university to the start-ups via the UBI. Representatives of the university can serve as a member in the advisory board of the UBI.

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TABLES AND FIGURES

		Non-profit	For-profit	Total
Europe	**Number**	41	16	57
	Percent	72%	28%	100%
America	Number	58	3	61
	Percent	95%	5%	100%
Rest of world	Number	11	1	12
	Percent	92%	8%	100%
Total	**Amount**	**110**	**20**	**130**
	Percent of total	**85%**	**15%**	**100%**

Table 1: Profit orientation by region

Professional services provided (Yes/No)	**All**
Business plan/development and strategy planning	88%
Assistance with starting business operations	86%
Assistance with raising external financing	83%
Entrepreneurship education	76%
Market research, marketing and sales assistance	72%
Research and development	63%
Accounting, tax and legal assistance	63%
Human resource consulting	55%
Human resources and organization	42%
Providing seed financing	41%

Table 2: Professional services offered by an UBI (Lendner, 2003)

Organizational services provided (Yes/No)	All
Office and lab space	94%
Contacts with public support institutions	91%
Organizing networking with external partners	89%
Logistics and infrastructure (e.g. IT and telephone)	88%
Shared social services (e.g. meeting room, restaurant)	83%
Shared services (e.g. secretary, cleaning)	80%
Organizing partnering within the incubator	79%

Table 3: Organizational services offered by an UBI (Lendner, 2003)

	employee growth of incubatees						
Funding from university through	yes		no		avg.		significance
	MW	n	MW	n	MW	n	
Equity	94,78	32	92,48	95	93,06	127	0,876
Grants / subsidies	108,93	28	88,58	99	93,06	127	0,187
Donations	79,43	7	93,86	120	93,06	127	0,607
Own cash flow	76,81	26	97,25	101	93,06	127	0,197

Table 4: University involvement in funding of UBIs

	employee growth of incubatees						
University members as committee	yes		no		avg.		significance
	MW	n	MW	n	MW	n	
Board of directors	87,83	80	105,6	43	94,05	123	0,199
Advisory Board	97,88	81	85,88	42	93,78	123	0,390
Investment committee	93,85	26	93,82	96	93,83	122	0,999

Table 5: University involvement as committee member

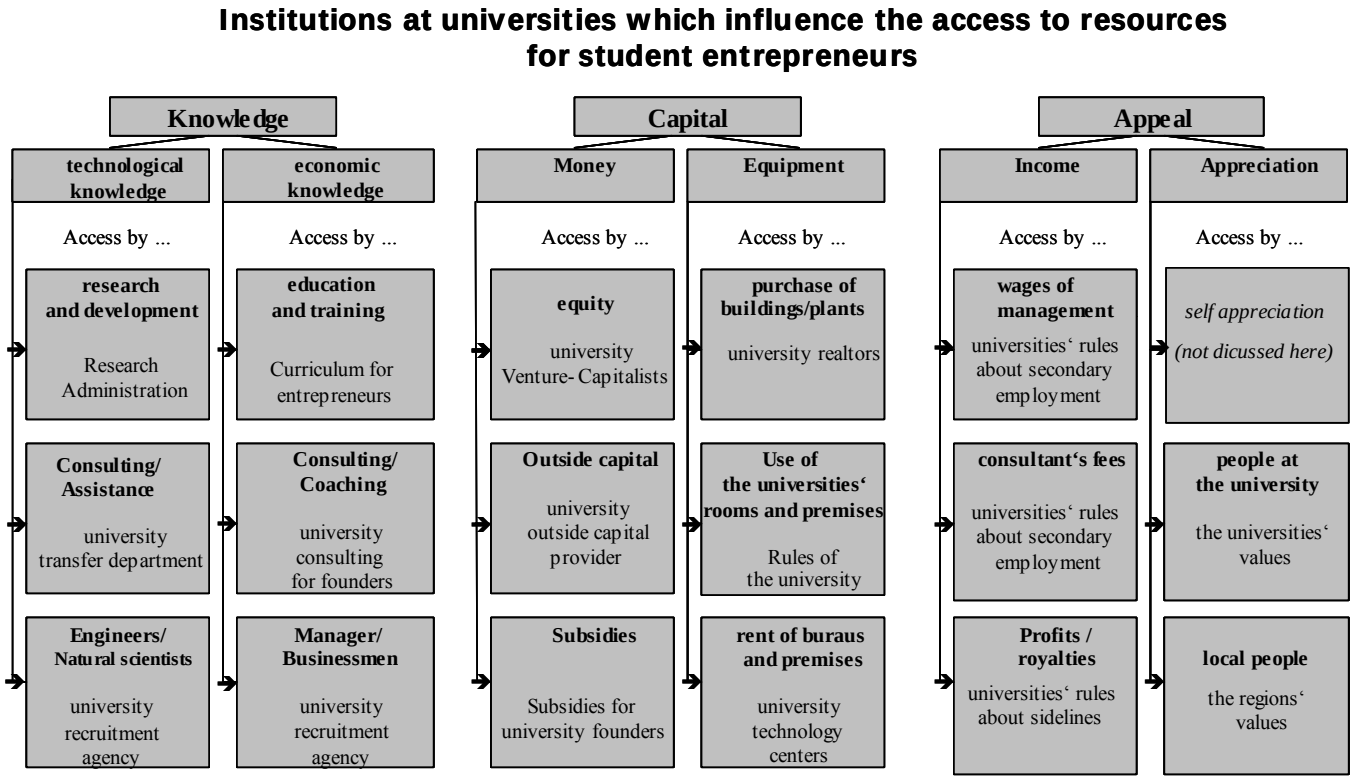

Figure 1: Availability of resources at universities (Lilischkis, 2001)

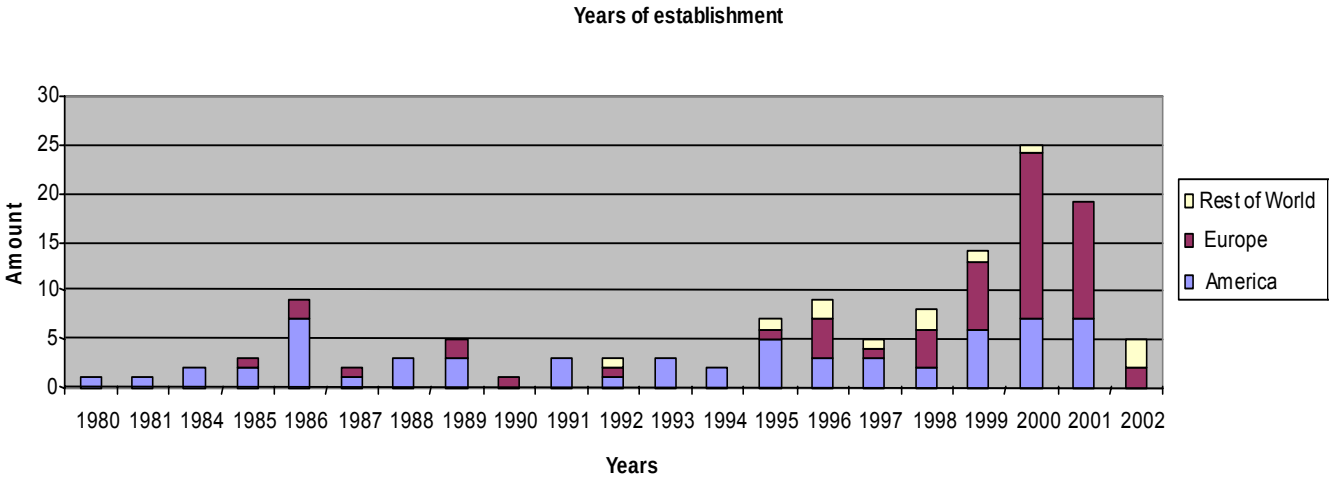

Figure 2: Year of establishment of the UBI (Lendner, 2004)

Smart Policies for Entrepreneurial Regions. Future Strategies for the Promotion of Start-Ups with Special Reference to an "Entrepreneurship Center Thuringia" (Germany)

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Acknowledgement

The project initiative was funded by "GET UP – Thueringer Existenzgruender Initiative." We are grateful to the funding body for supporting our project initiative with the title "ENTREPRENEURSHIP CENTER THUERINGEN (ECT)." We are also grateful to Dr. Charles Wessner, The National Academies, Washington D.C. for his comments and suggestions.

ABSTRACT

With an exploratory study we aim to focus on the research question of which policies contribute to the entrepreneurial environment of the State of Thuringia in the near future with special reference to public initiatives fostering the encouragement, motivation and qualification of (university-based) start-ups. In this paper, we provide a concept for an

innovative management of an “Entrepreneurship Center Thurinigia” (ECT). Our concept is based on “3Ps” which bring together

(1) “profile”

(2) “profit”

(3) “professionalism”.

The optimal interaction of the “3Ps” converging in a one-stop institution (ECT) will be introduced. We will explore the potentials of our business model, and the effects specifically for the encouragement, motivation and qualification of (university-based) start-ups.

1. INTRODUCTION

According to recent research findings it can be assumed that local public policies play a crucial role in the achievement of regional economic development or, at least, in the achievement of regional attractiveness (Audretsch, 2002; Florida, 2003; Porter, 1990; Sternberg, 2002). Therefore, local policy-makers constantly aim to improve the entrepreneurial environment for start-ups and small and medium-sized enterprises (SMEs) with a wide range of programs and initiatives. In most German states, numerous public programs for the promotion of start-ups were initiated and re-designed during the last few years in order to improve the entrepreneurial environment after evidence has accumulated that national, regional, and urban growth is strongly correlated with a significant rate of entrepreneurial activity, as well as a significant turnover rate of old and new firms per year (Audretsch et al, 1992; Fritsch et al, 2004a; Fritsch et al, 2004b; Sternberg et al 2000; Sternberg et al 2001; Reynolds et al 2001).

Smart policies are definitely needed to constantly improve the entrepreneurial environment of areas. Smart policies matter to induce economic growth within regions. But what are the key components of a smart policy mix which contribute to the attractiveness of regions and the entrepreneurial environment? A comprehensive answer is still missing and is difficult to achieve. It is impossible and, above all, not useful to develop a one best-practice-policy-mix-fits-all regions, as well as a one best-practice-management-fits-all regions. Areas have to develop their perfect policy mix based on their individual historical, cultural, social, economical, and political experiences.

With the following exploratory analysis we aim to present a policy approach specifically designed for an innovative strategic management of a one-stop-shop located in the State of Thuringia, the so-called "Entrepreneurship Center Thuringia" (ECT). The ECT is an idea developed by the so-called "GET UP Thueringer Existenzgruendungsinitiative". This institution is currently promoting innovative start-ups in Thuringia, and aims to improve prevailing entrepreneurship policies. Based on the federal program, "EXIST-University-based start-ups," initiated by the Federal Ministry of Research and Technology, the GET UP initiative started its activities in 1999. Since then, the institution established a regional university network including all Thuringian universities which are focusing on very different research areas. The common goal is the promotion of technology based and innovative start-ups through a fruitful collaboration of the involved universities, the achievement of synergy effects on each other, and the improvement of the entrepreneurial environment in Thuringia. With the implementation of a future ECT, along with the transformation of GET UP, policymakers aim to install a one-stop-shop specialized in entrepreneurship policies and counselling while acting independently from public financing.

In this paper, special attention will be paid to the future ECT´s organizational structure, management and, above all, policies which aim to successfully contribute to the attractiveness of this region, and to the encouragement, motivation and qualification of university-based and

other start-ups which play a major role for an innovative and economically growing State of Thuringia. Evidence from an exploratory comparative German-American study on entrepreneurship policies will be integrated in our business model for a future ECT (Grimm, 2004; Huettche 2004; Grimm, forthcoming).

2. THEORETICAL FRAMEWORK AND RESEARCH QUESTIONS

While econometric theories and models traditionally say that economic growth came from firms, jobs, capital, technology, or natural resources, the key resource today is human capital, also entrepreneurial human capital. Technology is still an important growth component, but other factors came into play (Florida 2003). Therefore, new policies need to be developed and old policy approaches need to be re-defined for the strategic management of places (Audretsch 2003).

The ability of start-ups and small businesses to adapt and act quickly in a global world has always been striking. Along with the so-called globalization the pressure on the entrepreneurial world has increased to develop new products and technologies with accelerated speed. Small and innovative firms which are generated and run by creative, entrepreneurial people contribute greatly to regional economic growth. They need entrepreneurial policies which foster the regional attractiveness and smart policies to survive and succeed in a global economy.

With new policies and strategies local policymakers of the highly industrialized countries have tried to improve the entrepreneurial environment for start-ups and small and medium-sized enterprises (SMEs) during the last few years. Local public policies are getting more and more important in a global world in which cities and regions compete for entrepreneurs, investors, and consumers. Only the local policy-makers know best how to optimally promote their locality. Federal policies may offer an important and useful framework for the

promotion of start-ups and SMEs but the main impulse is expected to derive from local policies.

In Germany, the states, regions and urban areas have successfully worked out regional and local images and policies to compete inter-regionally and, in a global context, with regions and metropolitan areas across the world.

With our exploratory study we aim to focus on the research question of which policies will contribute to the entrepreneurial environment of the State of Thuringia in the near future. We aim to provide a model for an innovative management of an entrepreneurial Thuringian region supported by a one-stop-institution which is taking care of entrepreneurial matters. Our model is based on "3Ps" which brings together

(4) "profile"

(5) "profit"

(6) and "professionalism."

The optimal interaction of the "3Ps" will be introduced. Also, we will explore the potentials of the business model, and the effects specifically for the encouragement, motivation and qualification of (university-based) start-ups.

The profile of the ECT is based on its results and successes which are supposed to be achieved, on the one hand, by the promotion of a considerable number of start-ups, in particular, innovative new businesses and firms and on the other hand, by the provision (a) of financial resources for persons starting-up a business and (b) by professional consulting and counselling services. To form this profile, the ECT needs sufficient financial resources in order to support selected and promising business start-ups that will pay their way during their setting-up and business-securing stage.

For this reason, the enduring financial securing of the ECT will be in the foreground of the concept described. We will introduce an ECT business model taking into account that the independence from any public financing is one of the ambitious institutional goals. By providing practical examples and calculations we will underline the feasibility and future success of our model.

In addition, we will introduce a professional assessment and evaluation of the services rendered by the ECT which plays an important role for the reputation of such an institution. Alternative forms of financing will come along – that is our conviction – with a professional assessment of the performance of the ECT. This will contribute to the professionalization and the development of a success profile of the ECT.

3. HYPOTHESIZED STRATEGY OF AN ECT

We suggest that the ECT should play a central intermediary role for promoting entrepreneurship in Thuringia. This also includes the promotion of technology transfer between the universities and the entrepreneurial world by facilitating university-based staff and students who intend to start-up a business to leap easily and successfully from the university into self-employment. Thus, the ECT initiates successful business start-ups and contributes to job creation, as well as, to innovative economic growth within the Thuringian region. Packed into a formula this would mean: “ECT picks winners, ECT causes winners, and winners pick the ECT” (see Kenneth Flamm, 1999, about the Advanced Technology Program; Wessner, 2003).

The ECT will be distinguished from other facilities by promoting excellent, innovative, technology-oriented enterprises. It will contribute to patent development and application and to the development of new and innovative product ideas, business concepts etc. as well as job creation.

The consulting offered by the ECT will perfectly meet the requirements of innovative entrepreneurs. Special focus is put on researchers who are currently working and studying at local universities. Their entrepreneurial potential to using an innovative (product) idea for self-employment should strongly bee promoted by the ECT. An ECT business model is required to support talented but "hidden champions" from local universities with entrepreneurial capacities. A suitable business model should, therefore, be characterized of the following catchwords ("3Ps"):

Profile: The ECT renders high-class services (counselling), establishes and maintains networks (networking), and is a reliable intermediary for the provision of capital.

Professionalization: The ECT is renowned for highly qualified counselling provided by service-oriented and professional staff for a transparent company organization structure and for achieving excellent results (meaning successful business support) on a long-term basis. The services rendered by the ECT will be assessed and evaluated which contribute the high degree of professionalization.

Profit orientation: The ECT focuses its work on the customer's benefit. The goal is that an entrepreneur profits along with the assistance of the ECT. Attractive financial assistance programs -- public private partnership and professional consulting -- are elementary components of the ECT. The profit orientation is a prerequisite for the survival and financial independence of the ECT.

4. PROFIT ORIENTATION BY PUBLIC PRIVATE PARTNERSHIPS

The ECT business model which we have designed is characterized by basic public private partnership (PPP) essentials. Therefore the instrument "public private partnership" (PPP) will be introduced in the following chapter and its tasks and form of organization will be defined. The objectives and fundamental interests of a PPP will be explained.

4.1 What does Public Private Partnership mean?

The term “public private partnership” describes very different forms of cooperation between the public and the private sector (Bertelsmann Stiftung, 2003). The partners participating in a PPP are, on the one hand, public actors, and on the other hand, both private-business actors (for-profits) and also nongovernmental actors (non-profits).

In practice, numerous various types and forms of PPPs have been developed. In literature, definitions are provided which usually refer to both a narrow and a broad understanding. With the broad understanding of the term PPP, any form of cooperation is understood between the private and the public sector (Linder et al 2000). PPP is narrowly defined as the cooperation between public institutions and private enterprises exclusively implemented as a joint endeavour of more or less equal partners who pursue specific complementary objectives. With such a PPP, a qualitatively independent organization form is introduced. (Vogel et al, 2000: 11)

A major objective of a PPP is the advanced management of public tasks. The increase in private involvement raises expectations that the quality and efficiency of public services will increase at the same time. The public and private sector may cooperate “…during the planning, the preparation, the financing, the operation, or the utilization of public services rendered so far by public institutions” (Bertelsmann Stiftung, 2003: 9).

4.2 Characteristics

An essential criterion for the functionality of a PPP is how and to what extent responsibility is shared among the partners. Individual forms of PPPs differ with regard to the influence of the private versus the public sector and the responsibility of each participant. Among other things, a proper distribution of risk and comprehensive responsibilities of the private partner

are considered to be central elements of a PPP. The numerous PPPs which exist in practice are distinguished from each other by the different intensity of cooperation.

A key practical consideration that often shapes PPPs is the desire to attract private investors. The financing aspect is often central for founding a PPP. In practice, various forms of private financing have been developed contributing to the maintenance of public infrastructures and services. Vogel and Stratmann (2000:16) categorize different financing models. With regard to the future organizational structure of the ECT, two models are of particular interest: (1) Remuneration models including, for example, funds, licence models, leasing, object corporations, and the lease model. (2) Fundraising for founding a PPP including, for example, donations, sponsoring, benefits from foundations, and the marketing of own resources.

4.3 Triggers and Objectives

The enthusiasm for the increase in private involvement in public policy fields is rooted in the changing requirements to fulfil public tasks. Both in Germany and also in the Anglo-Saxon countries the emergence of PPPs is interrelated with the economical, political, and structural changes and the emergence of a so-called service economy (Gerstelberger, 1999). Certainly, the financial bottlenecks of the public treasuries are dramatically increasing. This contributes to the rising attractiveness of PPPs. Globalization along with the development of a knowledge society push forward the search for new organizational forms. The interest of the economy in PPPs is primarily focused on commercial aspects which may, however, not only be aimed at direct profit.

> "Alternatively the business partner may have a concern to develop market credibility by being associated with government, or may have political motives such as gaining an `insider´ position in policy processes, working to achieve policy outcomes favourable to business." (Carroll et al, 2000:50/51)

With PPPs policymakers pursue very different objectives, among others, the financing and administering of formerly purely public duties and services as well as the improvement of

innovation processes and an advanced control of administrative and other processes. With the help of PPPs, there is practically "an entrepreneurial model introduced in the public sector" (Vogel et al 2000). It serves as a vehicle for the reorganization of the public sector and contributes to an increased efficiency. PPPs matter with regard to the optimization of expenditure and revenue, the improvement of organizational processes, and the pursuing of objectives by working applied-oriented and process-oriented. A higher efficiency is achieved by an all-embracing approach which permits to bring together the best experts of individual disciplines.

4.4 Recommendations for the ECT

The most prominent PPPs which promote regional economic development exist between the private sector and communes, state authorities, universities or technical colleges, Chambers of Commerce and Industry, Chambers of Crafts and Trade, and banking and credit institutions.

For the ECT, the following fields of cooperation are, in our opinion, of particular interest:

- An R&D consortium comprising small and medium-sized companies, local universities, and – if necessary – the public sector;
- PPPs between local universities and the public sector for the promotion of innovation-led processes, as well as the encouragement of spin-offs from Thuringian universities;
- PPPs between local universities and other public/state laboratories and research facilities to encourage the implementation of technology and/or knowledge clusters in Thuringia;
- PPPs between the state public sector, banking and credit institutions and small and medium-sized enterprises (SMEs) in order to provide micro-financing and

other early-stage funding options for innovative start-ups.

Since the business landscape in Thuringia is characterized of small and medium-sized enterprises, large-sized enterprises do not play a significant role in the above listed recommendations.

5. BUSINESS MODEL FOR AN INNOVATIVE ENTREPRENEURSHIP MANAGEMENT IN THURINGIA

In the following, we specify the „3P“ strategy for the “Entrepreneurship Center Thuringia” as introduced in chapter 2 while taking into account major features of U.S. public private partnerships which can successfully be transferred cross-nationally to Germany and cross-regionally to Thuringia. In our opinion, the implementation of PPPs at different organisational levels will contribute to the sustainability and success of such a one-stop-shop. With the ECT concept and “3P” strategy, we aim to introduce a regional policy approach as well as an innovative management strategy while bearing in mind the historical, cultural, economical and political experience of Thuringia.

5.1 Profile and Profit

Our concept is based on “3Ps” which bring together “profile”, “profit”, and “professionalism” in one institution. We assume that the profile of the ECT is sharpened if professional, demand-oriented counseling is provided.

5.1.1 Potential Sources of Revenues

Individuals who aim to start-up a business need know-how, contacts, and capital. The demand for the three assets is dependent on the development status of the enterprise. Know-how is achieved by counselling offered by the ECT primarily focusing on operational,

organizational, and technical aspects of an entrepreneurial endeavour. The ECT establishes contacts between partners from science, industry, financing, and (potential) entrepreneurs. For this purpose, formal and informal, regular as well as cursory meetings need to take place.

Counselling and networking are a necessary prerequisite but not a sufficient component of the business model ECT since the revenue potential from the consulting activities is very low. We recommend that the first counselling provided to potential start-ups has to be free of charge.

Capital is the trigger for realizing business. Counselling is useful to assess which financing sources are existent and, if necessary, how to apply for loan capital. The entrepreneur accepts (pre-money) and is able (post-money) to pay for the provision of capital. This source of revenue is essential for the sustainability of the ECT on a medium-term and long-term basis. At the same time, a successful provision of capital underlines the high potentials of the ECT and will raise its reputation. Those entrepreneurs who have (a) been successfully promoted by the ECT and (b) received subsidies or loan capital are satisfied customers who may get back to the ECT to ask for further excellent services which can be priced accordingly.

The following simplified numerical example underlines the above-mentioned presumption:

With a staff of 20 employees, the ECT has a budget of about 2.000.000 Euro. Out of 20 ECT employees, 15 are working operatively. Sixty percent of their working time goes to the invoiceable counselling of persons starting-up a business. On the assumption of 200 working days, this results in 1,800 man days (200 x 1.800 x 0.60 €). The following table shows the required per diem rates provided that the calculation is based on the assumption of (1) no other revenues, (2) 25% of other revenues and (3) 37.5% of revenue portion for the provision of capital and 12.5% of other revenues.

	(1)	**(2)**	**(3)**
Required per diem rate for consulting services	1.110	833	555
Revenues from the provision of capital	0	0	750.000
Other revenues	0	500.000	250.000
Target turnover	2.000.000	2.000.000	2.000.000

The calculations above clarify that an ECT business model which is solely based on counselling will not pay its way without any public or other financial support. It is unrealistic

to assume that an entrepreneur is able and willing to accept a per diem rate amounting to 1.110 Euro (calculation model 1).

With the second calculation we suggest that counselling and other services will be charged by the ECT. We assume that all consulting hours which have been performed can be invoiced, are invoiced, finally paid and will be charged with 833 Euro (calculation model 2). Also, based on the assumption that the ECT organises seminars, workshops, fairs, etc. and charges them with an average entrance fee of 50 Euro, it would require (a) 20 paying participants per event and (b) such events taking place each working day (this means 250 events per year!) to achieve a target turnover of 2.000.000 Euro. In other words, a total number of 500 potential entrepreneurs attending these events each month are required.

If the ECT does, however, act as a service and management agency we can draw a revenue model paying its way (calculation model 3). Three to five percent of the gross investment is invoiced as commission to the ECT for providing an entrepreneur with loan capital or other subsidies. In addition, the so-called “soft expenses” may be added to this commission. This means that other costs are liquidated via the issue price of shares which may amount to two to eight percent of the fund volume. If the ECT is issuing a fund of a small size with a volume of supposedly 10.000.000 Euro it can be awarded with an estimated peak revenue of 1.000.000 Euro.

5.1.2 Provision of Capital

In its capacity as a technology agency of the Free State of Thuringia, the ECT promotes branch-specific innovations and innovation processes. Public subsidies are offered as an award for future innovative projects in selected areas (nanotechnology, opto-electronics etc.). Similar to the U.S. Small Business Innovation Research program (SBIR) though tuned to Thuringian necessities and pre-conditions we suppose that subsidies should be offered in a three-phase process. During phase I innovative ideas and proposals are submitted and

evaluated by (university-based) individuals, university laboratories and departments, and potentially also small and new enterprises in a standardized way. All proposals are subject to a comprehensive and rigorous selection process.

If the applicant fulfils the previously defined requirements and selection criteria and is positively evaluated by reviewers in phase I, the entrepreneur receives a basic amount of capital to demonstrate the technological and economic feasibility of his or her project in phase II. Only those applicants successfully completing work in the first phase of competition are permitted to submit proposals for a basic research effort in phase II. Whether he or she has successfully completed work in phase I will be determined by reviewers and by the reaching of specified goals.

Phase II proposals are subjected to a comprehensive and rigorous selection process that includes the consideration of an in-depth evaluation which will be conducted by independent scientists or engineers and ECT employees knowledgeable in the specific field of technology of the proposal. Optimally, this second evaluation is based upon extensive information including the success of the phase I effort documented in a final report from the applicant and a commercialization plan developed by the applicant. We recommend that only the most promising results should be promoted with another subsidy.

In the third stage (prototype, reference customer), public funds are matched with private investments (Wessner, 1999a). The applicant has to find a strategic cooperation partner and an investor who provides matching funds. The partner might be a large industrial company, a venture capital firm, an individual “angel” investor, the state government, a local or regional government or even the federal government or any combination of the above mentioned alternatives. Phase III is for product development to commercial markets using private sector financing. The creation of public private partnerships is a major goal of the U.S. SBIR program.

The following figure designed by the National Science Foundation illustrates the three-phase process of the SBIR program.

Figure 1

The ECT is in charge of the award process, including the invitation to bid, the selection, and the awarding of subsidies. Both the successful award winners and the ECT will be evaluated at a continuous basis.

The ECT needs to receive public funds at the initial stage of its existence. This public support contributes essentially to the economic development of the Free State of Thuringia. An evaluation of the ECT makes this clear and de-emotionalizes the public discussion whether public funding for such an institution really pays off. The success of the ECT can be measured in various aspects: economically, politico-economically (local economic development) and politico-scientifically (university development) (for other characteristic features see Wessner, 1999b:36). The success of innovative, university-based and other entrepreneurial persons who successfully participate in the three-phase award process and started-up a business reflects the fruitful work of the ECT. As a result, the ECT becomes a trustworthy partner of innovative entrepreneurs and private investors.

5.1.3 ECT as Service Agency

5.1.3.1 Corporate and Innovation Venturing

"Corporate Venturing" (CV) is, in general, understood as the establishment and development of participations by already existing enterprises for strategic and financial considerations (Faisst 2002:5). With regard to innovative projects, one speaks of "*Innovation Venturing"* (IV) (Campbell et al., 2003:32). With respect to CV and IV, the ECT establishes research

networks between small to medium-sized businesses and enforces the dialogue between universities and the business sector.

5.1.3.2 Entrepreneurial Sponsoring

The sponsoring of sports events and cultural events has a long tradition. The sponsoring of new firms, the so-called *"Entrepreneurial Sponsoring"* (ES), is relatively unknown, in Germany, although it may directly contribute to job creation and is of far superior importance than classical sponsoring. In this way, enterprises may demonstrate impressively that they assume responsibility for the common good.

We suppose that funds spent so far for culture and sports are dedicated to other purposes like the support of entrepreneurs of the region. The ECT may, then, initiate appropriate projects to attract sponsors, and focus on the promotion of selected branches or regions. Also, the ECT should set up good media contacts for an effective promotion campaign.

5.1.3.3 Corporate Hatching

By *"Corporate Hatching,"* it is understood that the ECT looks after young, already established enterprises until they achieve their organizational independence. These so-called early birds are not of high interest to classical Venture Capitalists for the time being (Jugel, 2003). The ECT accelerates the growth and maturity process of promising technology-oriented enterprises. Market maturity and orientation are reached in a quicker way by firms which have been consulted by the ECT. The companies show a technological lead and consolidation of organizational structures. Now a private commitment is worthwhile.

In its capacity as a service agency, the ECT finances itself by means of remunerations charged for various services. In case of the successful provision of capital, young start-ups will be charged commissions.

5.1.4 ECT as Management Agency

The ECT sets up owns funds focused on specific branches (opto-electronics fund, media fund) or regions (Ilmenau fund). The shares are issued on a small-part basis and offered to the citizens as well as to institutional offers. The selling is directly executed via the ECT (by telephone, internet) or via the savings banks.

If the Free State joins as co-financiers, the non-payment risk of the investors is minimized – taking into account the tax effect – and a reasonable yield is reached even under considerable risks of the seed financing.

5.1.4.1 Public Private Partnerships for the Promotion of Innovation

We propose that ECT should raise and administer a "Zukunftsfond Thüringen" ("Future Fund Thuringia").

Figure 2

In the beginning, the Free State should participate as a limited partner of a limited liability corporation and buying a share or shares. Private investors may join the fund with a contribution of 5.000 EUR or the multiple of this sum as limited partners. Each share which has been bought and allocated is matched with a free-of-charge transfer of a share of the Free State amounting to the same sum. This procedure is neutral as far as the taxes on income are concerned.

This model leads to a doubling of the available financial assistance funds thanks to the recruiting of private funds. Their yield on shares doubles. By including the fiscal effects in the case of losses (allocation of losses), the property risk is easy to grasp.

The ECT liquidates structuring costs of the fund plus margin via the emission prices (we propose 5% of the amount subscribed for each time). A variable remuneration is charged for

the attendance. If the fund invests into young enterprises, a commission for the intermediary can be taken into consideration.

5.1.4.2 Management of Funds of Third Parties

If the ECT acquires the status and distinguishes itself as a fund manager, it may also structure and attend to funds of third parties. According to the participation model outlined above, it is also possible to finance investments and collaborations of the Free State and/or of the communities by recruiting private funds. The ECT assumes responsibility for the conception and control of the fund. The ECT liquidates structuring costs of the fund plus margin via the emission prices as a proposal 5% of the amount subscribed for each time. A variable remuneration is charged for the attendance.

5.1.5 Networking

Establishing an ECT network means, above all, establishing an informal organizational form which is characterized by the common interests of its members and which is strongly influenced and professionally managed by the ECT.

5.1.6 Entrepreneurial Counselling

Entrepreneurial counselling is a central task of the ECT. Public counselling for potential start-ups is heavily dependent on public funding; without this public support, this service has to be revised. All and any services offered by the ECT have to be assessed with regard to the added-value. Additional value means, on the one hand, profit-making: The person starting-up a business pays the ECT an honorarium for a certain service. But added-value means, on the other hand, binding effect. The person founding a new firm today will be the entrepreneur of tomorrow and, thus, a potential customer who requires qualitatively first-class consulting services and/or capital. An adverse counselling (initial counselling) is acceptable if a person starting up a business is linked to the ECT with a lasting effect.

Without any public financial support, it is required to offer the counselling in a profitable way so that at least the costs are covered (profit orientation). Initial consulting activities are usually executed free of charge. If consulting services do not have a binding effect, it is possible to standardize them and to render them on a more cost-effective basis. The same contents are imparted in another form by internet-based counselling. Customers are referred to the respective websites and they need to pay for the utilization. If it is possible to reach a binding effect in certain consulting segments, links to helpdesks are useful. Then a personal consulting session should be arranged with the ECT staff.

5.2 Professionalization

Profile goes along with professionalism and vice versa. A professional profile of the ECT depends on the quality of the organizational structure and of the personnel. Therefore the advanced and continuous training of the staff, the establishment of a stringent and transparent company organization structure, as well as the permanent evaluation of the institutional work and its personnel are preconditions for the success profile of the ECT.

5.2.1 Advanced Training of the Staff

The ECT aims to gain reputation as a technology agency. The personnel of such an agency must have a comprehensive knowledge and understanding of new and innovative technologies. They have to be able to assess the economic dimension of a new idea and product as well as the potentials of its commercialisation. The specialization on specific branches is imperative. The individual employee is the contact person for customers who plan to start up a business. If required, he or she establishes contacts with specialized scientists and links the innovator to the ECT network. On doing so, the economic dimension of the entrepreneurial endeavour will be in the foreground and not any process-technological issues. The ECT employee gains a reputation as trustworthy and credible partner having

comprehensive knowledge of branch-specific ratios, competitors, leading experts, etc. at his or her disposal. From the constant contact with submitted concepts and ideas, the employee gains an excellent knowledge of future developments, recognizes innovative trends, and branch-specific insights.

The ECT not only regards itself as a technology but also as service and management agency. A professional specialization of the staff is imperative. The more sophisticated the consulting, the higher the revenue potential. Accordingly, an advanced and continuous training of the staff is an essential element of the ECT business model. Therefore we recommend to implement a so-called “revolving-door concept”. This means that the employees of the ECT take over managerial functions in young enterprises or on the premises of financial or scientific partners for a fixed period with the intent to execute highly qualified tasks professionally within the ECT afterwards. Such a revolving-door concept contributes to the professional and personal qualification of the staff and the creation of multipliers. Information monopolies are prevented.

5.2.2 Evaluation

The continuous evaluations of (1) the promoted innovators and entrepreneurs, (2) the ECT, and (3) its personnel are essential elements of the business model.

The *Assessment Office (AO) of the ECT* should inter alia be entrusted with the following tasks:

- ***Planning, elaboration and realization*** of methods for the evaluation of the influence of financial assistance programs of the ECT on local enterprises, specifically on the regional economy.
- ***Execution and preparation*** of studies for the identification of outstanding investment and research opportunities contributing to the promotion of economic growth.

- ***Observation*** of the project and business development of promoted participants.
- ***Comparison*** of the ECT three-phase financial assistance program with other financial assistance programs (benchmarking) (Wessner, 2001).

The evaluation of the services rendered by the ECT should have high priority. A transparent marketing of the achievements of the ECT contributes to the image making process and professionalism of this one-stop-shop.

With the following toolkit we provide a basis for further discussion of which segments should be taken into account for future evaluation:

- Statistical collection of the
  - applicants/project partners/projects/participants of the projects
  - technologies/ ideas
- Continuous and regular evaluation
  - of the project teams
  - of the state of the art of the projects
- Reports on
  - completed projects
  - current projects
  - projects which have not been promoted by the ECT (!)
- Case studies on the
  - course of the project
  - question: why does the general public profit from the ECT and its work?

The evaluated results and analyses should be made accessible to anyone interested in and made available online. By this means, transparency would increase which essentially contributes to the image building of the ECT.

A follow-up on projects which have not been supported by the ECT should be achieved to find out whether ECT support is crucial for a successful business start-up.

6. SUMMARY REMARKS

We have developed an ECT business model which allows the realization of a one-stop-shop in Thuringia that professionally contributes to the start up process of technology-oriented, university-based enterprises in this region. The dimension and orientation of the model is scalable. A restriction to technology-oriented business start-ups can be made but is not a necessary prerequisite. The profit-orientation of the ECT is one essential characteristic of the introduced model in order to achieve an independent status (meaning independent from public subsidies). The suggested measures can be executed within 12 to 18 months.

We have strongly underlined the need for a public private partnership between different local actors keeping in mind that the increasing financial restrictions of the public as well as private sector in Germany will inevitably lead to a strong interaction between them. Therefore all proposed regional public, non-profit, and for-profit participants are actively involved in the promotion of start-ups.

We have referred to two best practice examples in the U.S., the SBIR and ATP program, which have successfully contributed to the promotion of innovative business start-ups in the U.S. and have transferred major elements of these two public promotion programs to the ECT business model. Both U.S. programs strongly promote the realization of public private partnerships which belong to the central instrument of U.S. entrepreneurship policy. Why is this not the case in Germany? In general, cultural, historical, but also legal reasons can be

given for this fact. The private sector does not gain reputation by contributing to job creation and the development of high technologies and therefore does not invest significantly in the promotion of the entrepreneurial environment. Potential sponsors do not profit from investments in PPPs. They can not see an image-building effect by investing in the promotion of the entrepreneurial environment so far. In the U.S., on the contrary, it belongs to the image building of an enterprise to contribute to the economic growth of the country or of the region by the promotion of business start-ups.

We are convinced that a future "Entrepreneurship Center Thuringia" will significantly contribute to the regional economic development and to job creation if it manages successfully to take up an active financial role with regard to the promotion of business start-ups, the development of state-of-the-art technologies, and the training of innovative, young, university-based and other talents.

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TABLES AND FIGURES

Figure 1: SBIR Model

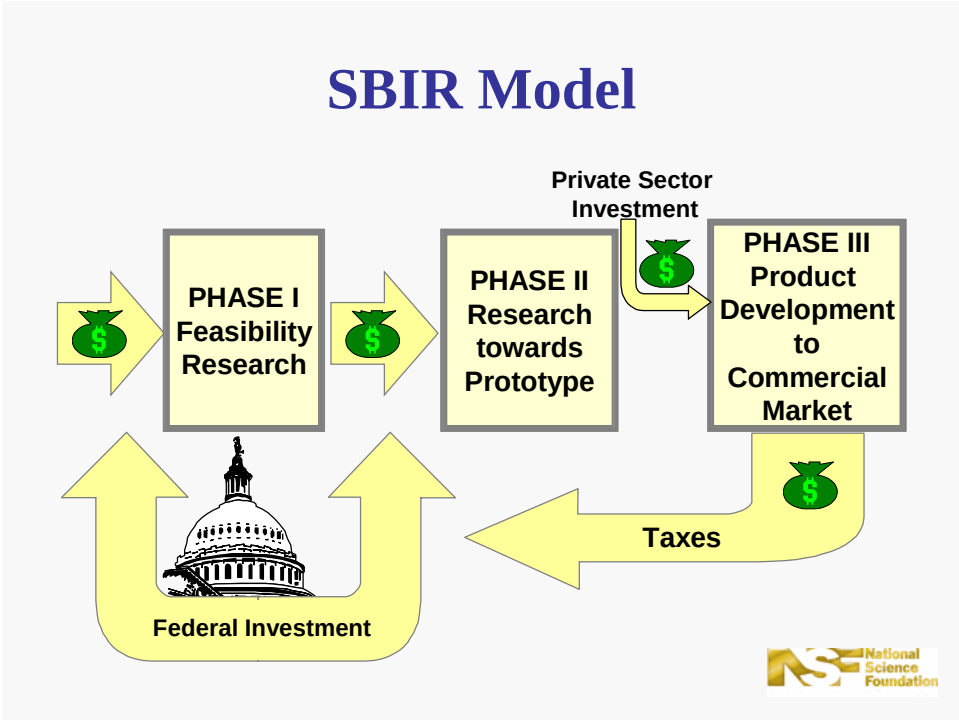
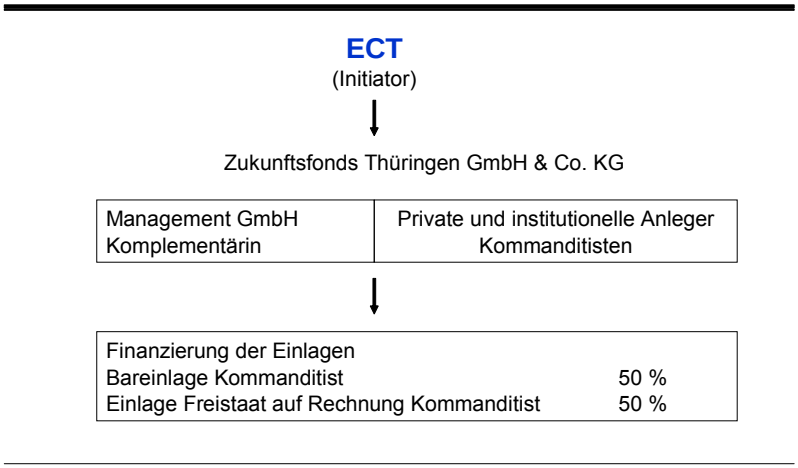


Figure 2: Zukunftsfonds Thüringen



Why Start-ups are the Last Thing to Do

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ETeCH AG is a Swiss-based private company investing in and developing emerging technologies with academic institutions across Europe, with an excellent track record. It recently published what has been hailed by leading centres worldwide as the definitive textbook on technology exploitation: **'Making Money out of Technology: Best Practice in Technology Exploitation from Academic Sources'** *(Linde Verlag, 2003).*

SYNOPSIS

Why do people continue to believe that founding and running a start-up is the right way to commercialize new technologies, when they also know that 90% fail? We believe there are three reasons: a lack of thought about what is the right thing to do as well as the right way to do it; a lack of knowledge about other options, propagated by institutions and individuals whose rewards lie in company formation; and a lack of understanding that enthusiasm is no substitute for commercial intelligence.

ETeCH's experience is that 90% of new technologies do not pass three simple tests of being legally owned, fulfilling market requirements, and being able to attract significant revenues - and in 90% of those which do pass, optimal commercialization is via trade sale or licensing,

in terms of the ***probable financial rewards to the originators***. In only 1% of cases should a start-up company be even considered as the correct choice.

The focus of many governments, incubators, science parks, managers in most venture capital companies, and members of the legal and accountancy professions, is however on start-up formation – because this provides immediate 'company & job creation' figures – and fees. However this short-term attitude, not caring about the failure rate, is compromising long-term wealth creation, and should be of concern to these institutions.

Although the majority of start-ups which fail do so because they were the wrong thing to do, rather than just being poorly managed, this is also a concern. Enthusiastic but commercially naïve 'entrepreneurs' are unacceptable vendors in many markets, and hard work is meaningless if the wrong things are done, or by the wrong people.

ETeCH's alternative approach, involving the precise selection of technologies and then the optimal exploitation route, with start-up formation only if this is demonstrably the best money-making course, has a proven record of 90% successful investments and >40% IRR over the last decade and more. ETeCH also assists Universities to structure technology exploitation to achieve the best financial gains with the least disruption to existing structures, staffing and budgets, and has collected performance data to provide international benchmarks.

In conclusion: if financial success and long-term wealth creation is desired, start-ups are the last thing to do. To be successful they must fit a much more constrained market niche in terms of their professional constitution and behavior than many believe. Universities should

preferably exploit valid technologies via internal development and then licensing or trade sale, which is usually more lucrative and less disruptive.

INTRODUCTION

Many people, and in our experience, particularly members of Universities and other academic institutions, continue to believe that founding and running a start-up is the right way to commercialize new technologies. Yet they are also aware that 90% of these fail, or, at least, fail to deliver their founders the originally hoped-for financial rewards. Why then is the belief in the merit of start-ups maintained, by otherwise intelligent people, in the face of the historical facts?

We believe there are three reasons: a lack of dispassionate thought about due diligence and the right way to commercialize; a lack of knowledge of, or consideration about, other options, where this blinkeredness is encouraged by a number of powerful and vocal institutions; and a lack of understanding that, in commercial markets, enthusiasm and energy are unacceptable substitutes for proper customer service. These three acts of willful blindness taken together – and set alongside the well-publicized success stories, although these serve to make our point - allow the prospective entrepreneur to belief that 'their case is different' and 'the times have changed' and the statistics - and the rules - do not apply. They are wrong. We shall thus look at these three reasons, in turn, in detail.

Lack of Thought

Firstly, there is the lack of dispassionate thought - or even, a definite suppression of thought - about what is the right thing to do as well as the right way to do it. This has two elements.

The first element is a marked reluctance to conduct proper due diligence, by carefully looking at rival technologies, patents, products and companies, by considering actually addressable markets, and by considering complete customer requirements. ETeCH's experience is that 90% of new technologies which we see from 'entrepreneurs' do not pass three simple tests of being legally owned, fulfilling market requirements, and being able to attract significant revenues. Of these the first 50% fail the simplest test of all – the technologies are simply not novel or legally owned, or have problems with freedom of action. A further 30% show, on proper, careful examination, no technical or commercial benefit over existing technologies, and the rest address small and/or difficult market niches – in short, the market may exist, but it is unwilling to pay.

ETeCH has formalized its due diligence process for selection of winning technologies – and over 90% of our investments are successful – in the 'ETeCH Technology Bridge'®. This forces us to consider each of key issues in turn, from the point of view of identifying applications, markets and customers, without prejudging the route to market.

See Figure 1: ETeCH Technology Bridge®

The second way in which lack of dispassionate thought expresses itself is as post-rationalization of the start-up choice, fuelled chiefly by greed and ego. The argument runs 'I have this technology and would like to see it developed – AND commercialised – AND make money from it – AND own a company which makes the money – AND run that company – AND have the status and all the trappings and recognition of being a CEO – and then people will realize how great I am'. The focus thus rapidly shifts away from the dispassionate consideration of what is the right way for the technology to be commercialized - creating the

business - towards what the often highly passionate desired way of commercialization by the person – creating the company, almost always around themselves.

Few business propositions can withstand such a shift, because even for those propositions which do pass the three simple tests of legal ownership, market acceptability, and reasonable potential revenues, in 90% of cases optimal commercialization is then clearly via trade sale or licensing, in terms of the ***probable financial rewards to the originators***. When such commercialization is instead attempted by a start-up, the desire to form and run the company has even actually overtaken the desire for the amount of money the originators would receive.

Trade sale or licensing is appropriate in the majority of cases because either the market is already developed, and dominated by large, powerful suppliers, and/or the customers - in fact, in most markets - insist on dealing with fully competent, professional companies as their suppliers. Such customers give no consideration for the supplier being a start-up, and in many cases will refuse to deal with companies whom they perceive as having any risk for delivery of products to the desired specification, quality, price, speed and volume. Even with – indeed, especially with – a desirable product, if the supplier cannot 'gear up' fast enough to match volume and quality market demands, the customers will not buy. Hence the 'classical' model of a new, unstructured, 'flexible' start-up trying to sell innovative products to big customers is often fundamentally flawed, depending on the markets addressed, because the way in which the customers want to buy is not the way in which the start-up thinks it should sell.

As a consequence therefore of this lack of dispassionate thought about the true merits of the technology and the correct way to approach customers, many technologies which are unsuitable for exploitation, or would be better exploited via direct licensing or trade sale, are

wrapped into start-up companies. These companies, even if well run, do not succeed because their proposition is unsuitable for the optimal technology exploitation in the chosen target markets. In our experience in only 1% of cases should a start-up company be even considered as the correct choice.

Lack of Knowledge

We thus come to the second reason for the blinkered view of start-ups: a lack of knowledge of, or consideration about, other options, where this blinkeredness is propagated by a number of powerful, vocal institutions and individuals, acting in their own best self-interest because their rewards lie more in the short-term of company formation rather than in the long-term of companies running successfully.

Start-up formation is the focus of many governments, incubators, science parks, managers in most venture capital companies, and members of the legal and accountancy professions. Creating large numbers of start-ups allows immediate and impressive 'company & job creation' figures to be reported for political advantage – and for the professional services providers, lucrative fees to be earned.

Government promotion of innovation and its commercialization, and its encouragement of the same by providing a variety of grants and services, is entirely welcome – provided, of course, it actually delivers on its promises - sometimes the politicians are good at promising and the bureaucrats less than willing to actually pay up. More, government promotion is vital, following recent fundamental legal changes in the ownership of intellectual property by academic institutions in many European states, which has led to considerable confusion about the possible, and highly stretched local resources. However, providing this government encouragement in ways largely requiring the 'forced-card' option of start-up formation, is far

from optimal. As we have shown, and as the statistics tell us, start-ups are nearly always inappropriate. Consequently the considerable power of government promotion is being ineffective in helping to establish sustainable companies and sustainable wealth creation, and serves more to sustain the professional and financial services providers. It is not unusual for some 30% of a start-up company's funds – just as, eventually, it is not unusual for 30% of the proceeds from an IPO, should one reach that far – to end up in the hands of the lawyers and accountants.

However this short-term attitude, not caring about the failure rate, is compromising long-term wealth creation for individuals, academic institutions and nations, and should be of concern to these. It is a key issue for the organizations promoting start-ups that the current 90% failure rate should be lowered considerably. Although a 'churn and burn' policy has been considered sustainable, for instance by some of the more aggressive late venture capitalists, and was certainly to the short-term advantage of certain individuals within these organizations, it cannot be maintained indefinitely. There will be too many 'burnt' individuals around. Consequently the long-term sustainability of the start-up approach requires, not that it occasionally works spectacularly, but that it often works well, and this dependability will also be vital for the survival of many of the institutions and organizations themselves, particularly the local ones.

This is a particular concern for European cultures, which have a low tolerance to failure, including the reluctance to reinstate academic staff who have tried to spin-out, with the consequent disruption to their University teaching and research. It means that there will be few success stories to learn from – one in ten - and even limited opportunities to learn from the failures, since no-one will talk about these. With little learning to be made, individuals

will become switched-off, and the negative cycle will continue with just more inappropriate, ineffective start-up formation by a new generation of naive young hopefuls.

If the success figure is to be improved, learning must occur. In our view this demands that much greater selectivity must be made with start-ups – that they are the right thing to do, as we covered earlier, and that they are to be done in the right way – which brings us to our third reason for the irrational view of start-ups, the lack of understanding that, in commercial markets, enthusiasm and energy are unacceptable substitutes for proper customer service.

Lack of Understanding

We have covered this partially before when we described customer demands for dealing with companies they view as dependable, and, although as we have seen the majority of start-ups which fail do so because they were the wrong thing to do, rather than just being poorly managed, doing things in the right way is also a concern. Much attention has recently been focused on this, with so-called 'entrepreneur training' for start-up managers, and venture capital investors are becoming much tougher on proper financial and other controls, but the facts remain that enthusiastic but commercially naïve 'entrepreneurs' are unacceptable vendors in many markets, and hard work is meaningless if the wrong things are done – or by the wrong people.

Even if the start-up is the optimal route, in many if not most cases it can be shown that the technology originators (or their 'middle manager' friends) are not the individuals best suited to run such a company, as is frequently proposed. The need for the company to be focused on the external issues of markets, customers, and customer satisfaction, frequently does not fit well with those who wish the focus to be on perfecting the technology, and the need for close

customer dialogue – listening to customer desires – is a skill not found in many managers whose previous posts did not call for this.

There is also, particularly for those academics unused to the commercial world, a lack of keen appreciation of the differences between money given for technology and company development as grants, money invested (with the expectation of returns) for technology and company development, and money earned from customers – which may then be used for further technology and company development. Those with an internal focus merely see the money coming in to allow them to pursue their work: but the financial community is, and so the company should be, concerned with where the money comes from and what it is expected to purchase. Grants are not capital, and neither are revenues.

Thus even in the 1% of cases from an original idea where a start-up company would be the optimal commercialization route, it is frequently not the sensible choice, simply through the inability of the originators to form a team to run a business to make money - and any company should not have any other agenda.

We have been able to determine that, in terms of the ***probable financial rewards to the originators***, a well-developed technology typically achieves more than 50% of this very rapidly – within two or three years of discovery - and usually before the technology has to leave the academic institution, and before company formation. The fact that most of their rewards are created early on is not usually appreciated by those originators who are hypnotized by 'hockey stick' value growth curves, failing to appreciate also the probable dilution of their stake. Thus even the start-up as a 'way to become rich' is, for the originators, largely a myth.

See Figure 2: The value-versus-time curve

Hence, selling out at this point – without taking on the problems of running a company – is almost always the advisable course for the originators and seed investors. 90% of the time licensing or trade sale is the optimal course anyway, and for much of the remaining 10% the inability to form a reliable business team means that a sale is advisable, for whilst perhaps not the most financially rewarding it is the course of lower difficulty, stress and risk.

ETeCH's ALTERNATIVE APPROACH

As ETeCH and its progenitor The Generics Group have shown it is, from the points of view of making money and avoiding risk and stress, better to develop lots of technologies and sell them early, using the proceeds for reinvestment, than to maintain a minor stake in a long-term enterprise.

Promoting, investing in, and enabling this alternative route to the start-up is what ETeCH does. ETeCH's approach, involving the precise selection of technologies and then the optimal exploitation route, with start-up formation only if this is demonstrably the best money-making course, has a proven record of 90% successful investments and >40% IRR over the last decade and more. ETeCH also assists Universities to structure technology exploitation to achieve the best financial gains with the least disruption to existing structures, staffing and budgets. Having collected performance data from around the world, ETeCH is able to provide international benchmarks to show how well any University ought to be doing from exploitation of its technology assets - and how poor is the achievement, as yet, of many. These benchmarks and statistics are given fully in our book 'Making Money out of Technology', but may be summarized as follows:

See Figure 3: Best Performance metric

See Figure 4: Comparison: M.I.T., Stanford, Cambridge, Oxford, ETH Zürich

In conclusion, then, if financial success and long-term wealth creation is desired, start-ups are the last thing to do. Certainly they have their place, but to be successful they must fit a much more constrained market niche in terms of their professional constitution and behavior than many believe. Universities should rather structure themselves to exploit valid technologies via internal development and then licensing or trade sale, which is more lucrative and less disruptive for the academic institutions concerned, and start-ups should be limited to those cases where the market dynamics clearly show that the start-up is the better course – and the individuals concerned have the key abilities of honesty, professionalism, and listening to their customers, to be able to create the new business.

ETeCH, 10th May 2004.

Figures

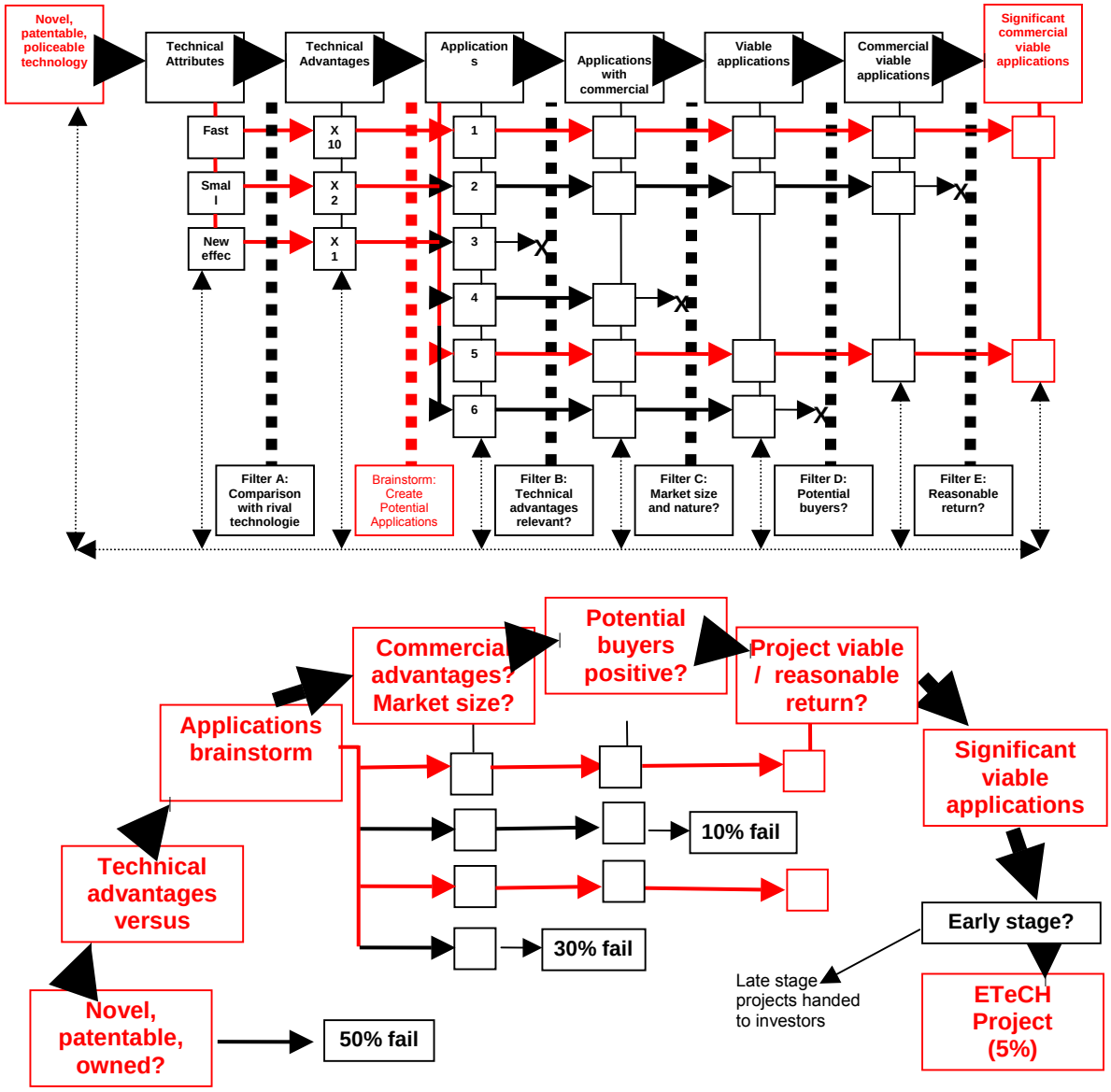

Figure 1: ETeCH Technology Bridge®

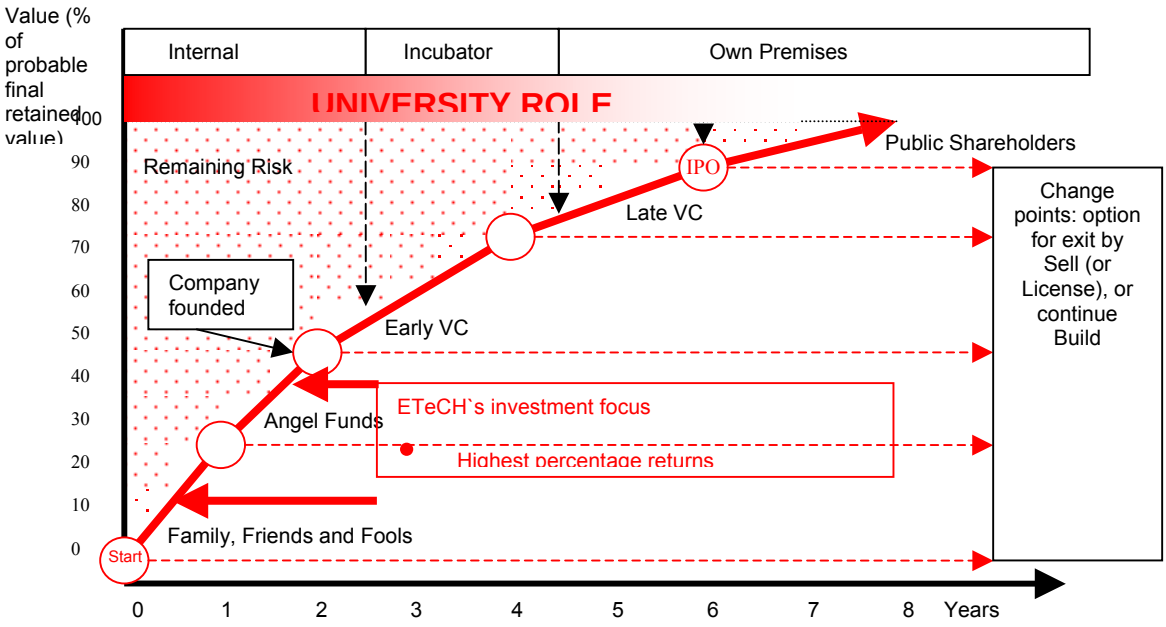

Figure 2: The value-versus-time curve

Best performance

- An average of one research disclosure per professor every two years - achieved MIT 2001
- Converting a third of these into patents
- Then converting three-quarters of these patents
  - Into license deals at an average of 250,000 Euro each
  - Or into holdings in spin-out companies where a realisable value of these could be an average of 1mEuro each
- This still brings in on average 3-6% of the research budget of a major University annually.
  - MIT and Stanford last year
  - MIT and Stanford bring in almost $3m per TT officer per year

Figure 3: Best Performance metrics

2001	MIT	Stanford	Cambridge	Oxford	ETH Zürich
Researchers	3000	8243	2556	3000	4953
Senior scientific research staff / professors	900	1701	1078	344 (professors & readers)	Unknown
Disclosures	446	321	~100 / ~100	319	Unknown
Patents	160	123	30 - 40	63	86
Companies formed	26 (160 total: has equity in 60)	17 (76 total)	5 / 6 (38 total)	8 (33 total)	10
Licenses	77 (+ 48 options) 600 active	113	30-40	32 (80 active)	29
Royalty income	€26.6m	€50m	€2.4m	€4.2m (inc. Ind. R.)	Not published
Equity disposal income	€55.6m	€2.12m	Not published	Not published	Not published
Valuation of holdings	Not published	Not published	Not published	Not published	Not published
University research budget	€850m*	€573.416m	€240m	€230m	€660m
% of research budget arising from TT	9.7% (4.50% as a 3 year average)	9.1%	1%	1.8%, including research	Not known

US universities total licence revenue $1.26bn, Top 10 average $71m, Overall average $4m, Best European $5.1m

Figure 4: Comparison: M.I.T., Stanford, Cambridge, Oxford, ETH Zürich